UNIVERSITAS BRAWIJAYA

ACADEMIC HANDBOOK

FACULTY OF AGRICULTURAL TECHNOLOGY

ACADEMIC YEAR 2020/2021

ACADEMIC HANDBOOK
FACULTY OF AGRICULTURAL TECHNOLOGY

UNIVERSITAS BRAWIJAYA
ACADEMIC YEAR 2020/2021

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INTRODUCTION

According to the Regulation of the Ministry of Research, Technology and Higher Education of the Republic of Indonesia No. 44 Article 3, 2015 concerning Higher Education Standards Framework, the objectives of establishing Higher Education include: 1) assuring the achievement of higher education goals, as it plays a strategic role in educating the nation, advancing science and technology by applying humanity values, culture and sustainable empowerment of Indonesians; 2) ensuring learning activities conducted by the universities in Indonesia through education, research, and community service as well as achieving the quality criteria set by the National Standards of Higher Education; and 3) encouraging the universities in Indonesia to improve the quality criteria of learning, research and community service established by the National Standards of Higher Education sustainably.

Therefore, a curriculum is established as referring to the Presidential Regulation No. 8, 2012 concerning Indonesian National Qualification Framework (IQF), a hierarchical framework of competencies of Indonesian workers which compares, equalizes and integrates the education sector, training sector and work experience in recognition of scheme of workability, which is adapted to the structure of many employment sectors. Therefore, this curriculum has been implemented at the Faculty of Agricultural Technology, Universitas Brawijaya since 2013. In addition, the students are equipped with the Academic Handbook of Faculty of Agricultural Technology 2020/2021 to assist them in understanding the Study Program curriculum implemented in the Faculty of Agricultural Technology, Universitas Brawijaya. Besides, it can be used by the students and lecturers as a guideline or reference in performing academic activities.

It is expected that this Academic Handbook will be useful in supporting students' learning activities at the Faculty of Agricultural Technology, Universitas Brawijaya in order to produce high-quality students.

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FACULTY OF AGRICULTURAL TECHNOLOGY
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I. EDUCATION PROGRAM OF FACULTY OF AGRICULTURAL TECHNOLOGY

1.1. UNDERGRADUATE ACADEMIC PROGRAM (S1)

The Undergraduate Academic Program provides a minimum cumulative study load of 144 credits by cumulative study length 8 to 14 semesters. The Faculty of Agricultural Technology consists of 3 departments: Department of Agricultural Product Technology, Department of Agricultural Engineering, and Department of Agroindustrial Technology and consisting of 6 study programs of undergraduate, namely Food Technology, Biotechnology, Agricultural and Biosystem Engineering, Environmental Engineering, Bioprocess engineering, and Agroindustrial Engineering.

1.1.1. DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY (THP)

1) Bachelor of Food Technology (TP)

This program offers scientific specification which covers the understanding of the agricultural product as biological material, knowledge of the main types of processes in converting biological materials into commodities, knowledge of processing machinery and equipment. Furthermore, it provides the ability to discuss problems in the commodity processing aspects, perform process engineering for new products, and operate the processing unit as a system and its optimization. The curriculum is also designed to meet the competency requirements of the Institute of Food Technologists (IFT), USA.

<u>Competence</u>

Food Technology graduates should have the following main components:

1. Understanding chemical, biochemistry, and physical properties of food material and occurred reactions affects food product quality.
2. Able to apply Physics, Chemistry, Biology, Mathematics, and Engineering science into operating systems and food and agricultural product processing to produce value-added, quality, and safe products.
3. Understanding food principles and analytical techniques and applying them to the food product quality testing.
4. Understanding the characteristics of beneficial and harmful microbes and able to use and control them in food processing.
5. Able to control quality and nutritional damage due to physical, chemical, biochemical, and biological changes in food products during storage.
6. Able to apply physical, chemical, biochemical, bioassay, microbiological and sensory testing techniques to evaluate food quality and safety.
7. Able to apply quality assurance and quality control principles relating to Good Manufacturing Practices (GMP), HACCP, TQM, and ISO Series.
8. Able to communicate in a team and effectively cooperate with stakeholders to respond to the agroindustrial development.
9. Able to think both logically and analytically to solve the problem faced professionally.
10. Having skills in using the latest information and communication technology.
11. Able to express ideas clearly either in written or orally.
12. Having a high sense of nationality and social care.
13. Able to work independently and in groups.
14. Able to be learners who always abide and align themselves with the progress and the development of technology and science.

Soft skills

1. Able to communicate/express opinions either in written or orally.
2. Able to identify problems, think critically, and give the solution.

3. Having professional integrity and being civilized.
4. Able to cooperate in a diverse team and able to solve conflicts.
5. Having a lifelong willingness to learn continuously.
6. Able to work effectively.
7. Able to lead the team independently.
8. Able to work under pressure simultaneously.
9. Able to update the knowledge and science they possess.

Knowledge

1. Able to clarify the cause of changes in the characteristics of food products and ingredients.
2. Knowing the basic principles of food analysis.
3. Knowing the basic principle of food processing technology.
4. Knowing the types of pathogenic and spoilage microbes that grow on food products.
5. Able to clarify influential factors to microbial growth.
6. Able to clarify principles of microbiological analysis.
7. Knowing the characteristics of food commodities, food ingredients, and food additives.
8. Able to clarify biochemical processes, basic nutrition concepts, and the correlation between food consumption and nutritional status and health.
9. Knowing the food-related regulations.

Hard Skill

1. Able to control chemical damage of food products and ingredients.
2. Able to determine the appropriate analytical method for food products and ingredients.
3. Able to apply the fermentation process to food preservation.
4. Able to identify and control the damage of food products and ingredients during production and distribution.
5. Able to apply principles of food engineering to the production process.
6. Able to carry out safe and quality food processing.

7. Able to determine the suitable type of packaging of food products and ingredients.
8. Able to carry out a hygienic food production process.
9. Able to use the computer and statistical principles in the food sector.
10. Able to apply knowledge of the quality assurance system.
11. Able to determine and carry out precise sensory testing.
12. Able to evaluate the nutritional value of food products and ingredients.
13. Able to calculate the nutritional adequacy rate of food products and ingredients specifically for labeling.

2) Bachelor of Biotechnology

The scientific focus as a target to the competence of the Biotechnology Study Program graduates is industrial biotechnology. The discipline deals with organism use, specifically microorganism (i.e., bacterium, fungus, and virus) and product generated by organisms (i.e., enzymes and metabolites) in the production process to yield goods and services on an industrial scale.

<u>Attitude</u>

1. Believe in God Almighty and able to behave religiously.
2. Upholding human value in carrying out duties based on religion, morals, and ethics.
3. Contributing to the quality of life improvement in society, nation, state, and to the civilization progress based on Pancasila.
4. Acting as citizens who are proud and love their homeland, having nationalism and responsibility for the state and nation.
5. Respecting cultural diversity, views, religions, and beliefs, as well as the original opinions or findings of others.
6. Cooperating and having social sensitivity and concern for the community and environment.
7. Abide law and being disciplined in social and state life.
8. Internalizing academic values, norms, and ethics.

9. Behaving responsibly for their work according to their field independently.
10. Internalizing the spirit of independence, fight, and entrepreneurship.

General Skills

1. Demonstrating verbal and written communication skills.
2. Able to identify problems, the cause, and make recommendations for solutions to the problem.
3. Able to apply critical thinking skills in a new situation.
4. Upholding the highest commitment to professional integrity, the value of social ethics, and environmental conservation.
5. Working effectively with other people from different backgrounds.
6. Able to identify personal weaknesses and develop themselves as lifelong learners.
7. Able to lead in various circumstances.
8. Able to solve either individual or group conflict.
9. Able to examine the information on scientific and non-scientific literature.
10. Able to use libraries competently.
11. Able to manage time effectively.
12. Able to facilitate group projects.
13. Able to manage assignments and pressure simultaneously.

Mastery of Knowledge

I. Mastering the basic concept of mathematics and natural science along with understanding its relevance to industrial biotechnology. The basic competence has three primary skills:
   A. Knowledge proficiency in the field of mathematics and statistics.
   B. Knowledge proficiency in the field of natural sciences (i.e., biology, chemistry, physics).
   C. Knowledge proficiency in the field of basic biotechnology.

II. Mastering theoretical concepts in biomass conversion to bioproducts (through the physical, chemical, and biological process) to support the realization of sustainable green bioeconomics. The main competence has three primary skills:

A. Knowledge proficiency in biomass as the raw material of bioproducts.

1. Distribution of biomass-based on taxa (virus, archaea, bacteria, protists, fungi, Animalia, and Plantae), origin (terrestrial and aquatic), and type (natural and processed products or waste).
2. Biological Biomass (genetic-principles of inheritance and its underlying molecular/cellular processes), database, and cross taxa interaction of biomass.
3. Chemical composition of biomass such as carbohydrate, protein, lipid, nucleic acids, and their primary and secondary metabolites.
4. Physical and chemical properties of biomass and its change due to the conversion process.
5. Biomass derivatization: types of derivatives (molecules, polymers, cells, and tissues) and their benefits.
6. Valorization of biomass derivatives through biorefinery principles so that its values increase.
7. Life cycle and principles of sustainable biomass management.
8. Biomass engineering for food, feed, medical, renewable energy, and the environmental sectors.

B. Knowledge proficiency in biomass conversion process on lab, pilot, and industrial scales.

1. Physical, chemical, and biological pre-treatment technologies for biomass deconstruction and decomposition and the extraction of its components (derivatization).
2. Bioprocess technology (principles, design, and bioreactor instrumentation) for converting biomass components into higher-value products (valorization).

3. Conversion reactions of biomass components into bioproducts: principles, enzyme, and its reaction.
4. Purification and separation techniques of *bioproducts* from other biomass components.
5. Technology of industrial biotechnology waste treatment.
6. Recent developments of the biotechnology industry processes.

C. Knowledge proficiency in products and services of the biotechnology industry and its bioentrepreneurship aspects.
   1. Bioproducts design and specification.
   2. System of quality assurance, safety, and authenticity of bioproducts, including halal food and medicines.
   3. Needs and segmentation of the biotechnology industry market.
   4. Traditional businesses that use biotechnology and development of bioindustrial products and services trends.
   5. Aspects of management and legal biotechnology business such as environmental conservation, copyright protection, patents, and trade strategies.
   6. Business models and the development of the small, medium, and large scale biotechnology enterprises.

<u>Special Skills</u>

Mastering technical knowledge and having specific skills that support the employment in industrial biotechnology.

1. Basic laboratory techniques in the fields of biology, chemistry, and physics.
2. Molecular techniques such as isolation of genetic material, gene expression analysis, protein production and preservation, and biochemical tests.
3. Cellular techniques such as screening, isolation, selection, and identification of microorganisms; cell propagation; cell viability measurement; and preservation of cell culture.
4. Bioproducts conversion techniques such as physical and chemical pre-treatment; biological breakdown; immobilization of

cells and enzymes; bioprocess design, instrumentation, and optimization; separation and purification of bioproducts.

5. Data retrieval, annotation, and interpretation from biological databases; data analysis using software and presentation.
6. Genetic engineering techniques such as plasmid design and assembly using gene sequence databases and software; transform plasmids into host cells; and transformant confirmation.
7. Strain improvement through random mutagenesis and DNA recombination technology.
8. Methods for the detection of contaminants, counterfeiting products, foreign genes, and transgenic organisms.
9. Bioentrepreneurship.

1.1.2. DEPARTMENT OF AGRICULTURAL ENGINEERING

1) Bachelor of Agricultural and Biosystem Engineering

This study program focuses on the application of production technology, utilization of agricultural products and materials, and natural energy by focusing on the formal object of engineering in the procurement of machinery, buildings, environmental control, and agricultural production systems and agricultural product processing.

The specifications of the sciences provided cover the basic agricultural engineering applications, the operation, and maintenance of agricultural equipment and machinery, the managerial skills to organize, develop and implement the new technologies, long-term and strategic planning of agricultural engineering aspects, agricultural engineering research, and development, design of agricultural engineering. Moreover, it scopes training and career development, installation, construction and manufacturing, security, reliability, work safety, and aspects of mechanization of material and agricultural product handling and marketing.

Competence

1. Having the ability to use engineering principles to design technology products related to agricultural engineering.

2. Innovative and creative thinking and attitude to work while adhering firmly to the engineering profession's ethics.
3. Having proficiency in managing and utilizing resources (agriculture and environment) and supporting resources (i.e., human resources, facilities, infrastructures, and so forth) optimally and sustainably.
4. Having a professional attitude and behavior, strong leadership, and communicating effectively scientifically.
5. Having proficiency in identifying, formulating, analyzing and solving the problems related to the agricultural engineering field through system approach.
6. Having proficiency in conducting research: exploring, developing, applying science and technology to the agricultural engineering field.
7. Having proficiency in developing entrepreneurship as the main actor oriented to agribusiness and agroindustry.

2) Bachelor of Environmental Engineering

Competence

The target of learning outcome of Environmental Engineering elaborates the graduates' competence, where they are;

1. Able to behave as virtuous human; have rational scientific thinking and express it according to the knowledge mastered in international relation.
2. Able to practice mathematics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), earth sciences, biology, fluid mechanics.
3. Able to formulate mass and energy balance and analyze the phenomenon of the transport of substances in the air, water, and land.
4. Able to carry out laboratory experiments, interpret data obtained from the main field (Remediation, Waste Treatment, Environmental Management, and Environmental Sanitation) or more.

5. Able to construct a environmental engineering system that covers risk, uncertainty, sustainability, life cycle principles, and environmental impacts consideration.
6. Able to apply advanced principles and practices relevant to the objectives of the study program.
7. Able to understand the concept of professional practice, project management, institution's rules and responsibility in lying environmental regulation and policy.

3) Bachelor of Bioprocess Engineering

Graduate Competence

We are preparing our graduates for in their career and professional life, and within a few years of graduation, as follows:

1. Graduates acquire professional leadership roles in bioprocess engineering and related fields leading to successful career
2. Graduates establish commitment and contributes toward sustainable and bio-based economy development for better society
3. Graduates engange in lifelong learning in conducting practical engineer tasks

Learning Outcomes

On successful completion of this program, graduates will have an ability:

1. To acquire a sound knowledge in mathematics and natural science and apply engineering principles in determining and solving contemporary and complex problems related to bioprocessing.
2. To formulate and operate conversion processes of biological resources into bio-based value added materials related to food, feed, fuels, pharmaceutical, nutraceutical, biomaterials or biochemicals.

3. To design biological reaction and reactors including its materials, instrumentation, control, and modeling.
4. To communicate creative idea and works effectively within professional community and larger society.
5. To demonstrate an ability to work in multidisciplinary and multicultural teams in developing innovative engineering solutions using complex problem-solving skills.
6. To conduct practice-based tasks related to bioprocessing in a responsible, safe, voluntary, self-motivated and ethical manner.
7. To appraise bioprocessing and bioproducts manufacturing and valorization using entrepreneurship principles.

1.1.3. DEPARTMENT OF AGROINDUSTRIAL TECHNOLOGY

The education of agroindustrial technology deals with an integrated system of agricultural products industry consisting of: humans, materials/ingredients, methods, money, and information. The basic science of agroindustrial technology is multidiscipline. It focuses not only on mathematics, physics, biology, but also on social science, economics, and management science. This study program has three pillars of science, namely technology, management, and system engineering.

1) Bachelor of Agroindustrial Engineering

Competence of Undergraduate Study Program of Agroindustrial Engineering graduates consists of 4 elements: Attitude, Knowledge, General Skills, and Special Skills, describing in the following details.

<u>Attitude</u>

1. Believe in God Almighty and able to behave religiously.
2. Upholding human value in carrying out duties based on religion, morals, and ethics.
3. Contributing to the quality of life improvement in society, nation, state, and to the civilization progress based on Pancasila.

4. Acting as citizens who are proud and love their homeland, having nationalism and responsibility for the state and nation.
5. Respecting cultural diversity, views, religions, and beliefs, as well as the original opinions or findings of others.
6. Cooperating and having social sensitivity and concern for the community and environment.
7. Abide law and being disciplined in social and state life.
8. Internalizing academic values, norms, and ethics.
9. Behaving responsibly for their work according to their field independently.
10. Internalizing the spirit of independence, fight, and entrepreneurship.

General Skills

1. Able to apply logic, critical, systematical, and innovative thinking in the context of development and implementation of science and technology that concern and apply humanities values following their field of expertise;
2. Able to show independent, quality, and measured performance;
3. Able to examine the implication of development or implementation of science and technology that concern and apply humanities values following their field of expertise based on scientific principles, procedures, and ethics in order to come up with either solutions, ideas, designs, or art criticism;
4. Able to compile scientific description on the result of the study into a thesis or final report and to post on the university website;
5. Able to make a decision appropriately in the context of problem-solving in the agricultural industry field based on the result of information and data analysis;
6. Able to maintain and develop networks with advisors, colleagues, fellows both within and outside the institution;
7. Able to be responsible for the achievement of the result of individual and group work and carrying out supervision and evaluation to the completion of work assigned to employees who are under their responsibility;

8. Able to carry out the process of self-evaluation in the workgroups which are under their responsibility and ability to manage to learn independently;
9. Able to document, save, secure, and rediscover the data to ensure its validity and avoid plagiarism.

Knowledge

1. Able to master principles of system engineering, technology, and management in the agroindustrial field.
2. Able to identify, analyze and select problem-solving alternatives of agroindustrial problems.
3. Having an awareness of the importance of lifelong learning.
4. Able to understand the profession's responsibilities, ethics, and social and be responsive to recent issues.
5. Having extensive knowledge to describe the effects of agroindustrial engineering solutions in a global, economic, environmental, and social context.

Special Skills

1. Able to apply principles of system engineering, technology, and management in the agro-industrial field.
2. Able to work together in multidisciplinary teams and building networks and to communicate effectively.
3. Able to apply environmentally friendly agroindustrial science and technology.
4. Able to design and evaluate sustainable agroindustrial systems.
5. Able to use methods, skills, and modern engineering devices required for agro-industrial engineering practices.
6. Able to apply technopreneurship principles in designing creative agroindustry.

1.2 MASTER PROGRAM

The master program's objectives are to provide students as members of society who have academic abilities that able to apply and develop academic expertise in science and technology in the field of agricultural technology. This program has a cumulative study load of at least 36 credits with a cumulative study period of 4 to 8 semesters. Currently, the program provides 3 study programs: Agricultural Product Technology (THP), Agroindustrial Engineering (TIP), and Agricultural Engineering (TEP)

1.2.1 Master of Agricultural Product Technology

This program offers interdisciplinary applied science learning programs that focus on the development of agricultural technology to produce research as well as qualified master graduates. This master program equipped postgraduate students with an in-depth understanding of scientific fundamentals related to the processing and treatment of food and agricultural products, such as chemistry and biochemistry, engineering and processing, nutrition, microbiology and biotechnology. The graduates are expected to be a pioneer in the community in solving problems related to the development of Agricultural Product Technology in the community, especially in the industrial sectors. Students can complete this postgraduate program for at least 4 semesters and at a maximum length of study of 8 semesters with a study load of 41 credits that comprise 17 credits of compulsory courses, 12 credits of elective courses, and 12 credits for the thesis. Competence of the Master Study program graduates covers main competence, special competence, and supporting competence.

Main Competence

1. Able to evaluate specific chemical reactions underlying properties and reactions of sundry food components/agricultural products.
2. Able to control chemical reactions that influence the damage and shelf life of foods and agricultural products.
3. Able to apply the latest processing technologies.
4. Able to determine the analytical method of food components/specific agricultural products.
5. Able to develop the concept of food and agricultural products processing technologies using engineering principles.

6. Able to explore beneficial microorganisms and metabolites in the food, agricultural products, and environment field.
7. Able to apply in an integrated manner various processing technologies to control putrefactive microorganism and pathogens growth in terms of food safety.
8. Able to evaluate changes in nutritional and non-nutritional compounds due to a processing activity and storage processes.
9. Able to apply statistical principles in solving problems of food/agricultural products.
10. Able to apply principles of food/agricultural product science to control and ensure food product quality.
11. Able to identify and solve food and agricultural products' problems by applying and incorporating food/agricultural product science principles.

Special Competence

1. Able to develop an integrated management system concept in the food and agricultural product industry.
2. Able to relate the factors that influence bioactive components utilization to their effect on the health by bioassay evaluation technique.
3. Able to carry out product development and innovation management.
4. Able to apply principles of shelf life and food product stabilization.
5. Able to carry out and evaluate the quality control system of microbiology and food safety.
6. Able to develop technology and innovative microbial-based product
7. Able to develop intervention and nutritional food products.
8. Able to apply computer science in solving problems of food/agricultural product science and technology.

Supporting Competence

1. Able to communicate effectively both in written and orally.

2. Thinking critically and analytically.
3. Having professional integrity and ethics.
4. Able to work together in various teams and solve conflicting problems.
5. Able to lead the team independently.
6. Able to work simultaneously in any circumstances.
7. Able to update knowledge and science obtained and being a lifelong learner.

1.2.2 Master of Agroindustrial and Biosystem Engineering

This master study program is directed to capability development to multiply cognitive abilities based on combining theory, research, and practical (applied) experience. The graduates will have values such as ethical behavior and good manners, high analytical skills, and mastering natural-based research which potential as superior products. Moreover, they can apply their research result on the development of environmentally friendly industries in the areas of interest whether Agroindustrial Machinery and Equipment Engineering, Bioprocess and Post-Harvest Engineering, Renewable Energy Engineering, and Environmental and Natural Resources Engineering. The postgraduate program can be completed for at least 4 semesters and at a maximum length of study of 8 semesters with a study load of 41-45 credits that comprise 15 credits of compulsory courses, 12 credits of elective courses, 12 credits of Interest Courses, 5-9 credits of Interest Elective Courses and the other 12 credits for the thesis. Furthermore, this program has the following learning outcomes.

<u>Main Competence</u>

1. Able to understand and develop engineering sciences to be applied to agro complex systems or biosystems field.
2. Able to inventory, identify, analyze/evaluate and design agricultural commodity process and environmentally friendly natural resource management.

3. Able to carry out environmental assessment and audit, precautions and countermeasures of environmental degradation and damage resulting from agricultural industrialization.
4. Able to keep up with the development of science and technology related to Agricultural and Biosystem Engineering.
5. Able to develop knowledge, technology, and.or art in Agroindustrial and Biosystem Engineering or professional practice through research to generate innovative and tested work.
6. Able to solve the problems of science, technology, and/or art in the field of Agroindustrial and Biosystem Engineering through either an inter or multidisciplinary approach.
7. Able to manage beneficial research and development to society and science and obtain national and international recognition.

Supporting Competencies

Able to understand and develop entrepreneurship basics and quality standardization and management.

Other Competencies

1. Able to work together in a team and to communicate effectively.
2. Able to understand the professional, ethics, and social responsibilities and respond to the recent issues.
3. Having an awareness of the importance of lifelong learning.
4. Environmentally friendly and having an awareness of sustainable agroindustrial development.

1.2.3 Master of Agroindustrial Engineering

Agroindustrial Engineering Master Study Program prepares students with academic abilities to apply and develop technology, management, and agroindustrial systems. This program can be completed for at least 4 semesters and a maximum length of study of 8 semesters with a study load of 40-45 credits that comprise 16 credits of compulsory courses, 12-16 credits of elective courses, and the rest 12 credits for the thesis. This program, moreover, is expected to generate graduates according to the Indonesian Qualifications Framework level 8 by the following competence:

Attitude

1. Believe in God Almighty and able to behave religiously.
2. Upholding human value in carrying out duties based on religion, morals, and ethics.
3. Contributing to the quality of life improvement in society, nation, state, and to the civilization progress based on Pancasila.
4. Acting as citizens who are proud and love their homeland, having nationalism and responsibility for the state and nation.
5. Respecting cultural diversity, views, religions, and beliefs, as well as the original opinions or findings of others.
6. Cooperating and having social sensitivity and concern for the community and environment.
7. Abide law and being disciplined in social and state life.
8. Internalizing academic values, norms, and ethics.
9. Behaving responsibly for their work according to their field independently.
10. Internalizing the spirit of independence, fight, and entrepreneurship.

General Skills

1. Able to apply logic, critical, systematical, and innovative thinking in the context of development and implementation of science and technology that concern and apply humanities values following their field of expertise;
2. Able to show independent, quality, and measured performance;
3. Able to examine the implication of development or implementation of science and technology that concern and apply humanities values following their field of expertise based on scientific principles, procedures, and ethics to come up with either solutions, ideas, designs, or art criticism;

4. Able to compile scientific description on the result of the study into a thesis or final report and to post on the university website;
5. Able to make a decision appropriately in the context of problem-solving in the agricultural industry field based on the result of information and data analysis;
6. Able to maintain and develop networks with advisors, colleagues, fellows both within and outside the institution;
7. Able to be responsible for the achievement of the result of individual and group work and carrying out supervision and evaluation to the completion of work assigned to employees who are under their responsibility;
8. Able to carry out the process of self-evaluation in the workgroups which are under their responsibility and ability to manage to learn independently;
9. Able to document, save, secure, and rediscover the data to ensure its validity and avoid plagiarism.

Knowledge

1. Able to design and develop scientific technology, management, and system engineering in the agro-industrial field.
2. Able to develop research, innovation, standardization, and dissemination activities of the agro-industrial field to produce innovative, tested, and competitive works.
3. Able to solve problems and make a decision and strategic policy through either an interdisciplinary or multidisciplinary approach in the environmentally friendly and sustainable agroindustrial system.
4. Able to develop map-based research through interdisciplinary or multidisciplinary approach either independently or collaborating with other institutions.
5. Able to develop networks with colleagues, agroindustrial users, and broader society.

Special Skills

1. Able to design, develop, and implement a solution to the agroindustrial problems in the system and industrial engineering, technological innovation, and agro-industrial business development.
2. Able to design, evaluate and/or develop technology to produce the more efficient and productive process/bioprocess, have value-added and higher competitiveness, and integrate environmental aspects into the agroindustrial system to realize sustainable agroindustry.

1.3 DOCTORAL PROGRAM (S3)

1.3.1 Doctor of Food Science

Food Science Doctoral Study Program provides students the flexibility to select courses that support their dissertation. The total credit students must take to complete the Doctor of Food Science program is at least 42 credits. The study load comprises 12 credits for one semester of the lecture. Furthermore, 30 credits of the dissertation consisting of

a. 1 credit of Qualification Exam,
b. 2 credits of preliminary/proposal exam,
c. 18 credits of research and seminar on the research result,
d. 4 credits of 1st and 2nd International scientific article publication,
e. 5 credits of dissertation writing and dissertation exam.

The doctoral program graduates' profile is expected to have the following capabilities:

1. Developing science and technology regarding food processing through research to produce creative, innovative, and original work.
2. Solving problems in science and technology related to food and agricultural products through the interdisciplinary approach.
3. Developing research and implementing the result to society as an attempt to acquire national and international recognition.

4. Taking roles as researchers, academics, practitioners, or professionals with reliable skills, mastering concepts and theories, and applying and developing food and related sciences.

Learning Outcome:
1. Able to carry out the food science development through research independently with either inter, multi, or transdisciplinary approach.
2. Able to carry out recent, innovative, and applicative research in food science to provide results and effects on the local food competitiveness.
3. Able to plan, manage, carry out and develop research roadmap in food science through either inter, multi, or transdisciplinary, approach which is beneficial for humankind.
4. Able to produce scientific work that has innovative, tested, and original novelty in food science and published in international journals.

Learning competences of the Food Science Doctoral Study Program that stated in the learning outcomes which refer to the Regulation of Ministry of Research, Technology and Higher Education no. 44 of 2015 concerning Higher Education Standard are as follow:

General Skills

Graduates of the Food Science Doctoral Study Program should have the following skills:
1. Able to invent or develop scientific theory/concept/ideas and contribute to the development and practice of science and/or technology which concerns and applies humanities values in their area of expertise by producing scientific research according to scientific methodology and the logic, critical, systematical and creative thinking;
2. Able to compile interdisciplinary, multidisciplinary, or transdisciplinary and theoretical research and/or experiment on

the field of science, technology, art, and innovation they produced in the form of dissertation and publish 2 writings in the indexed international scientific journals.

3. Able to select appropriate, current, and advanced research and provide benefits to humankind through an interdisciplinary, multidisciplinary, and transdisciplinary approach to develop and/or produce problem-solving in science, technology, art, or society based on the study of the availability of internal and external resources.
4. Able to develop a research roadmap in food science through either inter, multi, or transdisciplinary approach based on the study of main research objectives and its correlation to a broader target.
5. Able to compile argument and solution to the science, technology, or art according to critical view over facts, concepts, principles, or theories that can be accounted for scientifically and academic ethics and deliver it through mass media or to the society directly.
6. Able to show academic leadership in the management, development, and coaching of resources and organization under their responsibility.
7. Able to manage, save, audit, secure, and rediscover data and research results under their responsibility.
8. Able to develop and maintain collegial and peer-to-peer relationships within their environment or through collaborative networks with research communities outside the Institute.

Special Skills

1. Able to deepen food science development through independent research by interdisciplinary, multidisciplinary, or transdisciplinary approach.
2. Able to carry out recent, innovative, and applicative research in food science to provide beneficial effects on local food competitiveness.

3. Able to plan, manage, carry out and develop research roadmap in food science through either inter, multi, or transdisciplinary, which is beneficial for humankind.
4. Able to produce scientific work with innovative, tested, and original novelty in food science and published in international journals.
5. Able to deepen the synthesis of new food products containing bioactive components of natural ingredients based on studies in molecular, in vitro, and in vivo models.
6. Able to deepen the synthesis of food component derivatives and design its application in processing and food nutrition.
7. Able to deepen in the innovation process based on the deep understanding of basic concepts of food processing.
8. Able to deepen in the creation of specific processes to solve problems of food processing.
9. Able to deepen engineering and apply in an integrated manner the sundry processing technology to control the growth of putrefactive microorganisms and pathogen.
10. Able to deepen technology and product development based on creative, original, and innovative microorganisms.
11. Able to deepen functional food product development based on local food, which is scientifically tested to improve public health and safety.

Knowledge

1. Mastering the philosophy of food science, the theory of food science with a particular field of study, recent food science development, and the innovative capability to develop local resources and apply other relevant theories of the discipline.
2. Mastering philosophy of food components properties and roles to the change and form food characteristics.

3. Mastering philosophy of reaction mechanism and control according to the food product's reaction mechanism during processing and the damage to food products controlling.
4. Mastering philosophy of mechanism of extraction and separation of bioactive components from natural materials and determining the extraction techniques, separation of bioactive components, and their application in food products.
5. Mastering the philosophy of food component derivative synthesis and designing its application to food processing and nutrition.
6. Mastering the philosophy of extraction and separation of bioactive components from natural materials and determining extraction techniques, separation of bioactive components, and their application to food products.
7. Mastering the philosophy of characteristics changes of food raw materials and analyzing food component changes as an effect of processing.
8. Mastering philosophy of process innovation based on a deep understanding of basic concepts of food processing.
9. Mastering philosophy of specific process creation to solve the problems of food processing.
10. Mastering the philosophy of useful microorganisms and metabolite exploration and having novelty in the food, agricultural product, and environment field.
11. Mastering engineering philosophy and its application integratively to various processing technologies to control putrefactive microorganisms and pathogens.
12. Mastering philosophy of design, carry out and evaluate the system of microbiological quality control and food and agricultural product safety.
13. Mastering philosophy of technology and product development based on the creative, original, and innovative microorganism.
14. Mastering philosophy of biological value evaluation of nutritional components and biological activities of non-nutritional components by using the appropriate method.

15. Mastering the philosophy of functional food product development based on local food is scientifically tested to improve public health and safety.
16. Mastering the philosophy of new food products development with optimal quantity and quality of nutritional and non-nutritional substances to answer the problems of nutrition-food and health in society

1.3.2 Doctor of Agroindustrial Engineering

Agroindustrial Engineering Doctoral Study Program aims to generate reliable and independent researchers who are able to develop and utilize natural resource potentials to empower Indonesian society and help to achieve long-term development goals in the field of higher education in the purpose of increasing the quantity and quality of teaching staffs and researchers with doctoral degrees of Agroindustrial Engineering. The total credit students must take to accomplish Agroindustrial Engineering Doctoral Study Program is 42 credits. This credit load consists of 12 credits of one-semester lecture and a dissertation of 30 credits.

Furthermore, the doctoral program is expected to generate graduates with the following competencies, which, according to Indonesian Qualifications Framework level 9:

Attitude

1. Believe in God Almighty and able to behave religiously.
2. Upholding human value in carrying out duties based on religion, morals, and ethics.
3. Contributing to the quality of life improvement in society, nation, state, and to the civilization progress based on Pancasila.
4. Acting as citizens who are proud and love their homeland, having nationalism and responsibility for the state and nation.
5. Respecting cultural diversity, views, religions, and beliefs, as well as the original opinions or findings of others.
6. Cooperating and having social sensitivity and concern for the community and environment.

7. Abide law and being disciplined in social and state life.
8. Internalizing academic values, norms, and ethics.
9. Behaving responsibly for their work according to their field independently.
10. Internalizing the spirit of independence, fight, and entrepreneurship.

Knowledge

1. Mastering concept and theory of Agroindustrial Engineering science concerning the science of process technology, agroindustrial management, system engineering, and other related knowledge fields.
2. Able to integrate concept and theory of Agroindustrial Engineering science independently by the interdisciplinary, multidisciplinary, or transdisciplinary approach to the various professions.

General Skills

1. Mastering philosophy and theory of Agroindustrial Engineering science by the field of process technology studies such as optimization techniques of the production process, performance analysis of tools, and machine and competitive new product development.
2. Mastering the philosophy and theory of Agroindustrial Engineering science by agroindustrial management studies such as production plan aspects, productivity analysis, and agroindustrial production unit performance.
3. Mastering the philosophy and theory of Agroindustrial Engineering science by system engineering field, such as supply chain analysis and agroindustrial system integration.
4. Mastering the philosophy and theory of Agroindustrial Engineering science by the field of Agricultural Cultivation Mechanical Engineering, Soil and Water Engineering, Agricultural Mechanization Systems and Management, Food Processing and Agricultural Products Engineering, Agricultural

Energy and Electrification, Agricultural Environment and Buildings, and Agricultural Ergonomics and Electronics.
5. Able to plan and develop sustainable agroindustrial downstream.
6. Able to carry out innovation and its application to the agroindustrial system.
7. Able to comprehensively plan and evaluate the quality system in the field of agroindustry.
8. Able to analyze problems and develop a strategy of industrial policy from upstream to downstream aspects.
9. Able to design and develop integrated agricultural machinery and equipment innovations in food agricultural product processing.
10. Able to analyze and explore the application of waste treatment technology to achieve an environmentally friendly agroindustrial business.
11. Able to design and develop *a smart* farming system based on the information technology and control system.
12. Able to explore renewable energy to support the achievement of environmentally friendly agroindustry.

Special Skills

1. Able to produce scientific works that are innovative, tested and original, and have novelty in Agroindustrial Engineering science, particularly in technology, management, and system engineering science, and publish on a national and international scale.
2. Able to produce scientific works which are innovative, tested and original and have novelty in the field of Agricultural Cultivation Mechanical Engineering, Soil and Water Engineering, Agricultural Mechanization Systems and Management, Food Processing and Agricultural Products Engineering, Agricultural Energy and Electrification, Agricultural Environment and Buildings and Agricultural Ergonomics and Electronics through independent research activity by interdisciplinary, multidisciplinary, transdisciplinary approach and able to be published on a national and international scale.

3. Able to solve the problems and make a decision and strategic policy in the agro-industrial system's scope to provide outcomes and impact on agroindustrial performance improvement, sustainability, and competitiveness.
4. Able to plan, manage, lead, carry out, and develop the research roadmap in Agroindustrial Engineering science, which is beneficial for the agro-industrial system's stakeholders.

II. EDUCATION PROGRAM

2.1 BASIC UNDERSTANDING

2.1.1. Credit System

a. The credit system is a reward system for the credit of students, lecturers and study programs.
b. Credit is a unit representing the course of the study quantitatively.
c. Characteristics of the credit system:
   1. In the credit system, the score is given to each course, which is called a credit score.
   2. The total credit score for different courses will not always be the same.
   3. Each course's total credit score is determined by the completion of credits assigned in learning activities, practice, fieldwork, or other assignments.

2.1.2. Semester System

a. A semester system is a system of establishing an educational program using a half-year standard unit called a semester;
b. A semester is a time unit of an effective learning process, at least 16 (sixteen) weeks, including midterm and final examination;
c. Teaching and learning activities during one semester comprise of lectures, seminars, practical work, fieldwork practices, face to face teaching-learning, and structured and independent academic activities.
d. Each semester provides courses, each of which is granted with semester credit.

2.1.3. Semester Credit System

a. Semester Credit System is a credit system granted on a semester basis.

b. Two important objectives of Semester Credit System:

1. **General Purpose**

   Varied and flexible educational programs are necessary for enhancing Higher Education development. Therefore, each student will have a broader opportunity to determine and manage the curriculum and teaching/learning process strategy to achieve the best results following each student's plans and conditions.

2. **Specific Purposes**
   a) Enhancing opportunities for skillful and diligent students to complete the study at the earliest time.
   b) Facilitate the students in selecting the courses according to their interests, talents and abilities.
   c) Enhancing the implementation of multiple inputs and outputs in the education system.
   d) Facilitating curriculum adjustments with the latest development of science and technology.
   e) Assuring the implementation effectivity of an evaluation system on student learning progress.
   f) Allowing credit transfer from one to another or among Study Programs, Faculties in Universities, or intercollegiate.
   g) Allowing intercollegiate student transfer from one Study Program to another in a particular university.

c. Semester credit unit (credits) is a time measurement of learning activities imposed on the students on a weekly basis during one semester through various learning methods or recognition of student success in participating curricular activity of a study program.

d. Each course or academic activity is presented according to its semester credit unit representing the course load in the related semester.

2.2 CREDIT SCORE

2.2.1 The score for a semester credit

The score for the semester credit unit is determined based on student activities, including weekly activities as follows:

a. One (1) credit for the learning process: lectures, responses, or tutorials consists of:
   1. Face to face lectures for 50 (fifty) minutes per week per semester;
   2. Structured assignment activities 60 (sixty) minutes per week per semester; and
   3. Independent activities 60 (sixty) minutes per week per semester.

b. One (1) credit for learning process: seminar or other similar forms, include:
   1. Face to face activities of 100 (one hundred) minutes per week per semester; and
   2. Independent activities of 70 (seventy) minutes per week per semester.

c. One (1) credit for practicum learning, studio practice, workshop, fieldwork, research, community service, and/or other equivalent forms of learning equals 170 (one hundred seventy) minutes per week per semester. The semester credit score is as follows:
   1. Semester Credit Score for Laboratory Practice

      The score for a one-semester credit unit derived from Laboratory work equals to 170 minutes per week for one semester.
   2. Semester Credit Score for Fieldwork

      The semester credit unit's score is derived from fieldwork equals to 170 minutes per week for one semester (equal to 40 hours/week or @ 8 hours/day) of working hours.
   3. Semester Credit Score for Research and Final Assignment Preparation of Undergraduate program equals to 6 credits (6 x 170 minutes) per week, per semester, Masters Program equals to minimum 9 credits (9 x 170 minutes) per week, per

semester and Doctorate Program equal to minimum 28 credits (28 x 170 minutes) per week, per semester.

2.2.2 Semester Credit

Student's credit for one semester is formulated based on average working hours per day and individual ability. Commonly, people are required to work for 6-8 hours a day for six consecutive days, while students are required to work for longer hours per day as they have to work during the day and night. By considering students' regular working hours from 6-8 hours a day and two hours at night during six consecutive days, the student's studying hours will be 8-10 hours a day or 48-60 hours a week.

Therefore, a one-semester credit unit equals to 3 working hours, and the credit for each semester will equal to 16 - 20 credits or around 18 credits. It is essential to consider individual study achievement in the previous semester in determining semester credit measured by Grade Point.

Grade Point (GP) is formulated as follows:

$$IP = \frac{\sum_{i=1}^{n} K_i NA_i}{\sum_{i=1}^{n} K_i}$$

IP (GP): Grade Point, either semester grade point or the cumulative grade point

K : total credit course

NA : final grade for each subject

N : number of courses taken

For the first semester, all students are given the same total credits, then the GP of the first semester will be used as a measurement for total credit in the following semester. The course credit refers to the following table:

Table 2.1. Grade point and respective total units to be taken

Grade point (GP)	Units to be taken (units/SKS)
GP ≥ 3.00	22-24
2.50 ≤ GP < 3.00	19 - 21
2.00 ≤ GP < 2.50	16 - 18
1.50 ≤ GP < 2.00	12 - 15
GP < 1.50	< 12

2.3 CURRICULUM

Regulation of curriculum as teaching and learning process guidelines at Universitas of Brawijaya refers to Decision Letter of the Minister of National Education No. 232/U/2000 dated 20 December 2000, Act No.20 of 2003 concerning National Education System and Decision Letter of Dirjen DIKTI No. 43/ DIKTI/2006 and Regulation of Minister of Research, Technology and the Higher Education Republic of Indonesia No. 44/2015 concerning National Standard of Higher Education. The curriculum of the Undergraduate Program at the Faculty of Agricultural Technology is a competency-based curriculum, and its learning outcome refers to Presidential Regulation No.8 of 2012 concerning the Indonesian Qualification Framework.

1. Determination of study load of the undergraduate program curriculum is at least 144 credits, consisting:

   National Content General Courses Group

a.	Religion	(2 credits)
b.	Pancasila	(2 credits)
c.	Civics	(2 credits)
d.	Indonesian Language	(2 credits)

   University Content Courses Group

a.	Final Project	(6 credits)
b.	Field Practice	(3 credits)
c.	Community Service	(4 credits)
d.	Entrepreneurship	(2 credits)
e.	English	(2 credits)

The local subject of faculty will be arranged in a separate Chapter.

2. Master Program requires a minimum of 36 credits, including a Thesis (12 credits). Each study program develops the composition of courses. This Master Program shall be completed at least 1.5 years (3 semesters) and a maximum of 4 years (8 semesters).
3. Doctoral Program requires a minimum of 42 credits, including dissertation (30 credits). Each study program develops the composition of courses and to be completed at a minimum of 3 years (6 semesters) and a maximum of 7 years (14 semesters). Matriculation shall be done prior to a formal learning program (excluding a minimum study of 3 years). As recognized by the Ministry of Research, Technology and Higher Education, may take the doctoral and master program simultaneously for students with excellent achievement. Master Program to Doctorate for Honoured Graduates (PMDSU) is regulated in a separate Rector's Regulation.
4. English Language Competencies, Information and Communication Technology (ICT) and Intelligence Potential for Students of Universitas Brawijaya

The institutional curriculum applied to Undergraduate and Postgraduate programs at Universitas Brawijaya:

a. English Language competency, ICT, and Sports / Arts are non-credit activities (credit score = 0) but are prerequisites for each type and level of education.
b. The English proficiency/mastery is assessed using TOEIC, while TOEFL is used as a prerequisite to proceed to a higher level of education as follows:
   1) TOEFL ITP score > **400** for Undergraduate Program (S1)
   2) TOEFL ITP score > **500** for Master Program (S2)
   3) TOEFL ITP score > **500** for Doctoral Program (S3)
c. Skill in Information and Communication Technology, for each level and type of education, is determined as follows:
   1) Graduate Program : 1 (one) application program
   2) Postgraduate Program : 1 (one) application program

d. The potential intelligence of prospective students in the undergraduate program of education is assessed in an integrated manner through entrance examination.
e. Prospective students of the Master and Doctoral Program of Universitas Brawijaya are required to submit the Academic Potential Test (APT) with a score > 500 and issued by the authorized institution.

2.4 ACADEMIC SKILL ASSESSMENT

2.4.1 General requirements

1. The course academic skill assessment is conducted through structured assignments, quizzes, mid-tests, final tests, and practical activities.
2. The course academic skill assessment is conducted at least 2 (two) times in one semester.
3. The midtest and final examinations are conducted according to the schedule set in the academic calendar.
4. The objective of using structured assignments, quizzes, midterm, final and practicum examination assessments is to determine the final grade with required credits or adjusted to the course activities as stated in the Semester Course Plan.

2.4.2 Final Score

1. Course assessment is based on three alternatives:
   a. Using a Benchmark Assessment System (BAS) by determining the passing grade.
   b. Using a Norm-Referenced Test (NRT) system by comparing individual scores against group scores.
   c. Using a combination of BAS and NRT to assess the passing grade and compare it against the score of the selected group. It is suggested to use BAS or a combination of BAS and NRT in the scoring system.
2. The result of the final assessment is stated as Quality Letter and Quality Score as shown in the following table:

Table 2.2. Equality of Quality Letter and Quality Score

Quality Letter	Quality Score	Classification of Capability
A	4	Excellent
B+	3,5	Between excellent and good
B	3	Good
C+	2,5	Between good and fair
C	2	Fair
D+	1,5	Between fair and low
D	1	Low
E	0	Very low

3. The assessment is presented in Quality Letter (E-A) and converted into Quality Score (0-4).
4. The course assessment is measured according to course activity material equality with the whole course materials for one semester.
5. The final score is calculated by scoring each course activity within one semester using the following equation.

$$NA = \frac{\sum_{i=1}^{n} Bt_i \cdot Nt_i + Bq_i \cdot Nq_i + Bm \cdot Nm + Ba \cdot Na + Bp \cdot Np}{\sum_{i=1}^{n} Bt_i + Bq_i + Bm + Ba + Bp}$$

Descriptions:

Bt_i : score of structured assignment number- i

Bq_i : score of quiz assessment number- i

Bm : midterm examination assessment score Ba : final examination assessment score

Bp : practical assessment score

Nt_i, Nq_i, Nm, Na, Np: assessment score for each academic activity.

6. When the result of the formulation number (5) is converted to Quality Letters using the Norm-Referenced Test, the references will be as follows.

Table 2.3. The Conversion of Final Score to Quality Letter Score

Range of Final Score	Quality Letter
$80 < NA \leq 100$	A
$75 < NA \leq 80$	B+
$69 < NA \leq 75$	B
$60 < NA \leq 69$	C+
$55 < NA \leq 60$	C
$50 < NA \leq 55$	D+
$44 < NA \leq 50$	D
$0 < NA \leq 44$	E

7. The students may receive an incomplete score (K) if the course's score component is incomplete. If the score is not corrected within two weeks, the final score will be calculated based on the existing assessment components. However, if the missing assessment component is assessing practicum activities, the final score will be zero (K will be converted to E).
8. When the formulation number (5) is converted to Quality Letters using the Norm-Referenced Test (PAN), the references will be as follows.
   a) The class average, then its standard deviation is calculated.
   b) The final score is the average score ± standard deviation.

2.4.3 Courses Retake in Regular Course

1. Applicable to all courses for all grades
2. The previous practicum score is applicable when it has completed the administrative requirements, including theory and practicum.
3. The maximum score is A.
4. The highest score will be chosen.
5. Retaken courses must be immediately submitted to the academic department to remove the unwanted score.

2.4.4 Score Transparency

Lecturers are required to provide grade transparency by announcing percentages of midterm examination, final examination, and structured assignments (quizzes, papers, presentations, case studies, etc.). Final grades and percentage of midterm examination, final examination, and structured assignments must be announced through the faculty's academic/department administration.

2.4.5 Score Upload

Uploading score by the supporting lecturers shall follow the below terms:

1. The supporting lecturer must upload all of each course's scoring components during the midterm and final semester using SIADO online.
2. Final scores presented as quality scores have to be uploaded by the lecturers 10 (ten) working days from the scheduled final examination at the latest.
3. In case a lecturer exceeds the deadline for the uploading of the test scores, the academic operator will give a "B" quality score (quality score of 70). The score will be added to the score given by other lecturers within the same team to determine the final score.
4. Lecturers who are late in uploading the Midterm and Final Examination score will be given a warning letter from the dean.

2.4.6 Resits

Students are eligible to take resit after complying the following procedure:

1. Reporting the absence from the recent exam and wishing to take resit no later than 3 (three) days after the recent exam, except in force majeure conditions.
2. Submitting a permission letter for taking resit to the Vice Dean for Academic Affairs, enclosing evidence stating the reasons for not participating in the recent exam.
3. The letter must be sent no later than 7 (seven) days after the recent exam, except in force majeure conditions.

4. The acceptable reasons for taking resit are as follow:
    a. Sick (evidenced by the doctor's note).
    b. Parents and siblings passed away as evidenced by a Certificate from the Village / Subdistrict Head).
    c. Another reason that is justified academically and has received the approval of the Vice Dean for Academic Affairs.
    d. If a student is absent or unable to attend, then it is permissible to report through other people.
5. Resit is conducted no later than 1 week after the Middle Exam/ Final Exam ends (according to the Middle Exam or Final Exam that is enrolled) and fulfilling administrative requirements, except for force majeure conditions. If students do not comply this procedure, then they are not permitted to take resit.

2.4.7. Remedial Exam

1) Undergraduate Program

Students of the undergraduate program are able to take the remedial exam. They are required to participate in all academic activities related to lectures in the semester in which the course is taken and having attendance ≥ 80%. Moreover, it is intended for courses that do not meet the learning outcome. The provisions for the implementation of remedies are as follows:

1. Remedies are aimed to improve incomplete learning outcomes
2. Remedies are only carried once for one semester
3. The revised assessment tool is the part of the assessment tool that contributes to the incomplete learning outcome
4. The final score following remedial is the combined score of all teaching teams

2) Master Program

Students who take remedial examinations (remedies) are required to participate in all academic activities related to lectures in the semester where the courses are taken and have ≥ 80% attendance. Remedial exams are for subjects with the highest score of D +. However, the final maximum score of remedial exams is B+. The provisions for the implementation of remedies as follows:

1. Remedies are aimed to improve the Midterm and Final Examination score
2. Remedies are only carried once for one semester
3. Remedies are carried out following Final Exams and after the courses' scores have been announced through SIAM/Siakad
4. If the teaching team teaches the subject, then the material revised is the lecturer material with the lowest score
5. The final score of the remedial exam is the combined score of all teaching team
6. Scores of the remedial exam cannot substitute a structured task which has done
7. Students are required to calculate the scores obtained if they participate in remedial by considering all the assessment components and its load. If remedial can improve grades, then students have the right to participate. However, if the low score is caused by neglected structured assignments or components besides Midterm and Final Exams, students cannot participate in remedies.
8. Students can see the scores and load of the assessment components in detail in the department's administrative office or the lecturer coordinator who teaches the course.

2.5 ACADEMIC SANCTION

Academic sanctions are imposed on students who violate academic regulations:

1. Students who take less than 80% of course activities may not take the final examination, and the final score will be determined in compliance with the activities that have been performed (Midterm examination, quizzes, assignments, etc.). Any Issues related to attendance are clarified following a specified time limit.
2. A student cannot withdraw from a course after the specified time for registration and will be granted with E score if they do not attend the course based on the applicable rules.

3. Committing administrative violation (falsifying documents, data and signatures) and academic violation (cheating, working with other student (s), completing other student(s) examination and/or having other students completing their examination, taking other student's work) during the examination, will result in cancellation of all course plans during the semester.
4. Attempting illegal modification on course planning will result in the cancellation of all course planning during the semester.
5. Attempting illegal modification on students' scores will result in suspension for a maximum 2 (two) semesters, in which the suspension will not be considered as leave.
6. Students committing these violations and attempting threat, bribe, promise and deceit will be withdrawn from the faculty.
7. Committing violation (plagiarism and falsification of data) in fieldwork, internship, and final assignment reports will result in course plan cancellation during the semester.
8. Falsifying signatures on academic documents (course attendance, fieldwork/internship/Thesis proposals, fieldwork/internship/thesis reports, and seminar cards) will result in the cancellation of all course plans during the semester.
9. Committing violence and fights will result in the cancellation of all course plans during the semester and other sanctions following applicable laws and regulations.
10. A student committing a criminal offense and sentenced to a court with the permanent legal force of a minimum of 2 (two) years in prison will be withdrawn as the student of Universitas Brawijaya based on the Rector's Decree.

2.6 FINAL ASSIGNMENT FOR UNDERGRADUATE, MASTER, AND DOCTORAL PROGRAMS

2.6.1 Undergraduate Program

a. Final Assignment Scope and Status

Final assignment is a written scientific work conducted by students, including the results of research, internships, entrepreneurship, technological design work or other activities following scientific principles and ethics under the supervision of a competent lecturer and represents the students' competency in applying science, technology, art and/or humanities in a specific field of science. The final assignment must be prepared/conducted by each undergraduate student.

b. The Objective of the Final Assignment

The objective of performing Final Assignment is to equip the students with the skills in developing written scientific work to establish critical thinking, analysis, and synthesis against a phenomenon or problem by concerning the development of science, technology, art, and humanities, from the scientific perspective related to the study program taken by the students.

c. Activities in Developing Final Assignment

1. Any related source of data/information in preparing Final Assignment may be derived from research, internships, entrepreneurship, technological design work, and competitive scientific work. The scope of activities is listed in Table 4.5.
2. Terms of activities and procedures required in obtaining data/information are organized in the Field Work, Internship, and Final Assignment Handbook of Faculty of Agricultural Technology.

d. Content, Review and Understanding

1. The content of the Final Assignment is a theoretical study and/or an application of science, technology, and entrepreneurship according to the agricultural technology field of study.
2. Terms of content and in-depth review/understanding of the Final Assignment is organized in the Fieldwork, Internship, and Final Assignment Handbook of Faculty of Agricultural Technology.

e. Requirements, Students' Rights and Responsibilities

1. Students may perform a series of activities related to the Final Assignment after fulfilling the academic and administrative requirements arranged by the faculty.

2. Students are required to prepare the Final Assignment based on ethics and scientific manners, honest, free of plagiarism elements and refer to the Fieldwork, Internship, and Final Assignment Handbook of Faculty of Agricultural Technology.
3. All forms of learning outcomes such as intellectual property rights, articles in scientific journals, etc. related to the Final Assignment's material/substance are considered collective rights to the students and Rector, and the university.
4. In terms of collaborative research with another party, data and all forms of learning outcome usage right such as intellectual property rights, etc. are regulated in cooperation agreement and approved by the dean.
5. Ownership and intellectual property rights resulting from the implementation/preparation of the Final Assignment are organized separately by the Rector.
6. Terms of requirements, student's rights and responsibilities are organized in Fieldwork, Internship, and Final Assignment Handbook of Faculty of Agricultural Technology.

Table 2.4. Type of Final Assignment

Type of Final Assignment	Description
Research (6 credits)	The research activities are conducted in the form of laboratory or field experimental research, simulations/modeling, surveys, or corporate case studies.

Type of Final Assignment	Description
Internship (6 credits)	Practical work aiming at analyzing industrial performance or problems. Internship activities are conducted according to students' area of study and scientific principles such as problem identification, data collection, data analysis and conclusions. The internship program will be conducted for 60 effective working days, @ 8 hours/day.
Technological Design Work (6 credits)	Equipment or software design is based on futuristic concepts to solve existing problems or anticipate problems that might occur in the future.
Entrepreneurship (6 credits)	The entrepreneurial activities are related to the agricultural technology field of study, such as planning, implementing, man aging, controlling and evaluating business development. Such activities shall be performed at least within 12 months before the thesis examination, supported by cash flow books, a minimum of 3 workers and sufficient related documentation and proofs during the monitoring/visiting.

Type of Final Assignment	Description
Competitive Scientific Work (6 credits)	1^{st} - 3^{rd} winner of national and international competitions, finalists of Pimnas, or finalists in international level competitions related to agricultural technology field of study are not required to take thesis examination. Requirements for competitive scientific work: ▪ Thesis Supervisors are from the respective study program ▪ The topic is relevant to agricultural technology ▪ Completing the final assignments such as adding data where necessary and following the supervision process to improve the scientific work to be equivalent to the thesis is required. ▪ The national competition organizers must be certain government agencies or other credible institutions such as LIPI, Ministry of Research, Technology and Higher Education, Ministry of Youth and Sports, etc. The competition shall be conducted through scientific work and produces scientific writing. ▪ Student Creativity Guideline equivalent to thesis includes PKMP, PKMT, PSH, and PKMKC, while those that are not equivalent to the thesis are PKM-AI, PKM GT, and PKMM.

f. Requirements for Final Assignment

The students may take the Final Assignment after fulfilling any requirements as follows.

1. Registered as a student in the related academic year
2. Completing a minimum of 110 credits.
3. Minimum GPA of 2.00.
4. There is no E score.
5. D/D + score must not exceed 10% of the total credit.
6. Department has assigned the Final Assignment Supervisor no later than the 5^{th} semester.

g. Procedures and Methods in Preparing Final Assignments

The procedures and methods in preparing the Final Assignment have been organized in the Fieldwork, Internship, and Final Assignment Handbook of the Faculty of Agricultural Technology.

h. Credit Score of Final Assignment

The credit scores of Final Assignment for Undergraduate Program are as follows:

Research	: 6 credits
Internship	: 6 credits
Technological Design Work	: 6 credits
Entrepreneurship	: 6 credits
Competitive Scientific Work	: 6 credits

i. Time Duration in Preparing Final Assignment

1. The Final Assignment must be completed within 6 (six) months after being arranged in the course plan statement.
2. The extension of the Final Assignment duration must be verified by the Supervisor and approved by the Head of Department.

j. Final Assignment Supervisor

A minimum of one Supervisor will assist each student in conducting their Final Assignment.

1. Requirements for Supervisor:
   a. In conducting Final Assignment, the student will be supervised by at least one Supervisor whose position is at least an Assistant Professor with a Master qualification or an Instructor with Doctoral qualification in the respective field of science. In case the student is assisted by a Co-supervisor, he/she must acquire a position at least as an Instructor with a

Master qualification in the appropriate field of science or in a related scientific group of the study program where the student is registered.

b. The appointed Supervisor for "Competitive Scientific Work," which is equivalent to the thesis, must be a Supervisor for competitive scientific work of Faculty of Agricultural Technology, Universitas Brawijaya and assisted by a Co-supervisor with the abovementioned requirements. A Special Co-supervisor is a Co-supervisor from an institution or company with the required competencies.

2. Appointment of Supervisor
The Head of the Study Program proposes the Principal Supervisor and Co-supervisor to the Head of Department, and then they are appointed by the dean.

3. Tasks and Responsibilities of Supervisor:
   a. Main tasks and responsibilities
      1) Assisting the students in determining problem statements for the Final Assignment.
      2) Advising and monitoring the students in conducting the Final Assignment.
      3) Advising the students in writing the Final Assignment.
   b. The Co-supervisor is assigned to assist the Principal Supervisor in advising the students in writing the final assignment.

k. The Assessment of Final Assignment

1. The Final Assignment assessment is performed in preparing proposals, implementing, reporting, and examinations.
2. The Final Assignment will be examined by a minimum of 3 (three) and a maximum of 4 (four) Board of Examiners, including the Supervisors.
3. The Examiner must acquire at least the same qualification as the Principal Supervisor unless a specific requirement is needed, as stated in Fieldwork, Internship, and Final Assignment Handbook of Faculty of Agricultural Technology.

4. Detail qualification of Examiner, the procedure of assessment, and the Final Assignment examination procedure are stated in Fieldwork, Internship and Final Assignment Handbook of Faculty of Agricultural Technology.

l. The Characteristics and Purposes of Final Assignment Examination of Undergraduate Program

1. Final Assignment Examination for undergraduate program is a compulsory final examination to obtain an undergraduate degree.
2. The Final Examination for the undergraduate program is comprehensive.
3. Final Assignment Examination is performed orally to evaluate the student's competency in mastering science and technology based on their fields of expertise.
4. The objective of the Final Examination for the undergraduate program is to improve the students' low competencies.
5. The Final Assignment Examination can be conducted in open or closed examinations attended only by Supervisors and Examiners.
6. Final Assignment Examination is conducted for a maximum of 2 (two) hours.

m. Requirements for taking Final Examination for Undergraduate Program

The students may take the Final Assignment Examination for the undergraduate program under the following terms:

1. Registered as a student in the respective academic year.
2. Having completed a minimum of 138 credits and the excess credits cannot be deleted.
3. Minimum GPA of 2.00.
4. D and D + scores are not more than 10% of the total credits.
5. There is no E in the final score
6. Having completed the Final Assignment.

n. Application Procedure of Final Assignment Examination for Undergraduate Program

The department determines the application procedure of the Final Assignment Examination by considering any administrative and academic requirements.

o. Board of Examiners for Final Assignment Examination of Undergraduate Program

1. The Board of Examiners shall be determined by the dean as proposed by the Head of Department/Study Program.
2. The Board of Examiners consists of a Chairperson who also acts as Principal Supervisor and other 2-3 Examiners.
3. The board of experts shall be a lecturer who meets the following requirements: An Assistant Professor must acquire a minimum Master's Degree or an Instructor with a Doctoral degree. The appointment of the Board of Examiners excluding the above requirements is determined by the dean based on the Head of Department's proposal.
4. Non-Supervisor Examiners can be appointed from other agencies with respective science of student's Final Assignment as determined by the dean and proposed by the Head of Department.
5. Responsibilities of the Board of Examiners of Final Assignment Examination for Undergraduate Program:
   a. The Head of the Board of Examiners is responsible for organizing the examination process and provide his/her assessment.
   b. The Board of Examiners is responsible for examining and assessing the student.

p. Time Allocation for Final Assignment Examination

The final examination is conducted no later than 2 (two) hours.

q. Assessment

1. Assessment terms in Final Assignment examination:
   a. The quality of scientific work, including academic credit and writing procedures.
   b. Performace during the examination
   c. Mastery of the material is shown by answering questions from the Board of Examiners.

2. Determining the final score
   The Head of the Board of Examiners leads the board in determining the final score written in letters A, B +, B, C +, C, D +, D, or E. The final score includes the score of the final assignment and score of the seminars with credit specified in Field Work, Internship and Final Assignment Handbook.
3. To pass the final examination, the student must achieve at least a C grade.
4. Students who fail the final examination must comply with the decision of the Board of Examiners

r. **Undergraduate Judicium**

1. Students may take Undergraduate judicium under the following requirements:
   a. Students have completed all compulsory courses, including courses with national, university, and faculty/study program content.
   b. Students have revised the Final Assignment, obtained approval by the Board of Examiners and a minimum C score.
   c. Students have submitted the Final Assignment in the form of hard (light blue cover) and soft copy (on CD) and obtained approval by the Supervisors, the Board of Examiners, and Head of Department. The students are required to submit Final Assignment scripts/CDs to:
      1) Principal Supervisor
      2) Co-supervisor
      3) Library of Faculty of Agricultural Technology
      4) Library of Universitas Brawijaya
   d. Students do not exceed the maximum study period of 7 (seven) years.
   e. Students have uploaded the title and thesis approval at SIAM.
   f. Students have paid the semester tuition fees.
2. Graduation predicate consists of 3 levels: satisfactory, very satisfactory and with compliment which is stated in the

academic transcript. The Grade Point Average (GPA) is the basis for determining the predicate of graduation:

a. GPA : 2,00 < GPA < 2,75 : Fair
b. GPA : 2,75 < GPA < 3,00 : Satisfactory
c. GPA : 3,00 < GPA < 3,50 : Very satisfactory
d. GPA : 3,50 < GPA < 4,00 : With Compliment (Cumlaude)

The 'Cumlaude' predicate is determined by considering the maximum study period, a maximum of four years for the undergraduate program, no disciplinary sanction record, no C / C+ score (minimum B). For Degree Transfer students, the 'Cumlaude' graduation predicate is determined based on the acknowledged cumulative credit transfer of 70-80 credits (based on Dean's Decree) added with ≥ 65 credits earned at the Faculty of Agricultural Technology (based on Dean's Decree), with a maximum study period of 2 or 4 semesters. The faculty set the Judicium date based on Dean's Decree of Faculty of Agricultural Technology, Universitas Brawijaya.

2.6.2 Master Program

a. Scope and Status of Thesis

1. A thesis is an academic paper written as the result of an independent, in-depth study and contains new contributions to the development of science and/or technology by the master candidate under the Supervisors' guidance.
2. A thesis is a Final Assignment that must be conducted by master students at Universitas Brawijaya.

b. Purpose of Thesis Development

1. The purpose of drafting a Thesis is to encourage students in describing, analyzing and synthesizing the facts/symptoms or study results on mathematical theories and/or new designs that they have designed, or modifying/developing theoretical mathematical models, and/or existing and proven designs following their scientific principles.
2. Research is a rule-abiding activity to find the truth and/or solve problems that occur in science, technology and/or art.

c. **Activities in Obtaining Data/Facts**
    1. Data or facts used as the basis for preparing a Thesis must be derived from research activities, such as surveys and/or experiments using statistical/mathematical approach, or the results of in-depth study on mathematical theories/models under their scientific fields.
    2. Data must be obtained honestly and free of plagiarism.
    3. Terms of research activities/study mentioned in paragraphs 1 and 2, procedures for obtaining data, preparation and systematic writing and other technical matters related to thesis are organized in Fieldwork, Internship and Final Assignment Handbook of Faculty of Agricultural Technology.

d. **Thesis Credits**
    1. A thesis requires a minimum of 12 credits for a Master degree.
    2. The Dean of Faculty, under the proposal of Head of Postgraduate Program, outlines the Thesis credits based on students' activities, review/understanding and duration in conducting the Thesis work.

e. **Content and In-depth Review/Understanding**
    1. The substance of the thesis is the development of science, technology, or art according to the scientific field following the scientific field of study program where students are registered.
    2. Terms of substance and in-depth review/understanding of the thesis are organized in Fieldwork, Internship and Final Assignment Handbook of Faculty of Agricultural Technology.

f. **Requirements, Students' Rights and Responsibilities**
    1. Students may perform a series of Thesis-related activities after fulfilling academic and administrative requirements set by the faculty.
    2. Students are required to prepare a Thesis that is based on ethics and scientific manner, honesty, no plagiarism, and refers to Fieldwork, Internship and Final Assignment Handbook of Faculty of Agricultural Technology.

3. The Supervisor may use the data of the thesis as a source of publication in scientific journals/magazines or mass media by considering ethics and scientific manners.
4. All outcomes such as intellectual property rights, articles in scientific journals, and others related to the thesis's material/substance are cumulative rights among students, Supervisors, and the University.
5. In terms of collaborative research, the right to use data and intellectual property rights, etc. are stipulated under the cooperation agreement and approved by the dean.
6. Terms of ownership and intellectual property rights of the thesis, referred to in point number 4, will be separately stipulated by the Rector.
7. The dean stipulates further terms related to the requirements, student rights and responsibilities, and other terms referred to in point number 1 to 5 regarding Thesis preparation.

g. Qualifications, Determinations, Rights, and Responsibilities of Supervisor

1. Thesis preparation must be performed under 2 (two) or more Supervisors entitled with Doctorate Degree of the respective fields of science, or at least under the same scientific sub-group as students are registered with a minimum position at Assistant Professor.
2. Master Program of Faculty of Agricultural Technology and/or Postgraduate Program of Universitas Brawijaya may propose higher qualifications of the Supervisors than qualifications mentioned in point number 1, based on the proposal of the Head of Postgraduate Program.
3. Thesis Supervisors are appointed by the Dean of Faculty and/or proposed by the Head of Postgraduate Program.
4. Other terms related to qualifications, determination procedures, rights and responsibilities of the Supervisors are organized by the Postgraduate Program of Agricultural Technology of Universitas Brawijaya.

h. The Components of Thesis Assessment

1. The Board of Examiners, which consists of Supervisors and Examiners, assesses the Thesis research proposal in the thesis proposal seminar examination.
2. The Supervisors assess research implementation and Thesis writing.
3. The Supervisory team conducts an assessment of the Thesis research seminar in the Thesis Examination seminar forum.
4. Board of Examiners conducts a thesis examination assessment in the Thesis Examination forum. The Board of Examiners consists of Supervisors and Examiners.
5. The examiners are required to hold a Doctorate Degree with the position as an Assistant Professor.
6. Assessment criteria shall be referred to as the academic guidelines of each study program.
7. The percentage of assessment comprises six components; those are (a) Research proposal, (b) Research implementation, (c) Thesis writing, (d) Scientific publication, (e) Results seminar and (f) Thesis examination.

i. Thesis Component Assessment Score

The thesis component assessment score is as follows:

Table 2.5. The Component of Thesis Assessment

No.	Activities	Percentage (B) %	Score (N)	B x N
1.	Proposal	15	……….	………….
2.	Research	30	……….	………….
3.	Research Seminar	15	……….	………….
4.	Thesis Examination	40	……….	………….
	Total (∑ B x N)	100	……….	………….
	Average (∑ BN/100)			………….

The score is given according to the applicable system. The final score is the average score, as mentioned earlier.

1. A minimum passing score for Thesis Examination is B. If the student's score is less than B, they are required to retake the maximum once the Thesis Examination. If the student fails the retake Examination, he/she will be assigned a special assignment (approved by the Supervisory team) to revise the thesis manuscripts or fails the study.
2. Thesis revision (based on suggestions from the Board of Examiners) must be completed no later than one month after the Thesis Examination. In case the student exceeds the time limit and the thesis manuscript has not been completely revised without accountable reasons, the head of the supervisory team may suggest the student retake the Thesis Examination.
3. Students who have passed the thesis examination, and revised the thesis under the approval of the Supervisory team, may hard print the Thesis manuscripts to be distributed to the Supervisory team, Postgraduate Program Administer, Universitas Brawijaya, and other parties who need it). The thesis manuscripts will be approved by the supervisory team and Head of the Postgraduate Program.

j. Graduation and Graduate Requirements

Students are declared to graduate from the Master Program of Universitas Brawijaya when they complete at least 36 credits (including thesis) with GPA $\geq$ 3.0 and no D score(s) and acquire the following graduate requirements:

1. Acquire TOEFL or TOEFL equivalent certificate with a minimum score 500, obtained from an English Language Institute recognized by Universitas Brawijaya.
2. As referred to Circular Letter of Director General of Ministry of Research, Technology and Higher Education Number: B/323/B.B1/SE / 2019 concerning Scientific Publication of Undergraduate, Master and Doctoral Programs and Rector of Universitas Brawijaya Regulation No. 52, 2018, concerning Publication of Scientific Work of Master and Doctoral program, students of Master Program are required to publish a scientific

journal indexed by Scopus or Web of Science Core Collection (Thomson Reuters), and the lowest national journal accredited by Sinta 2, or Universitas Brawijaya journal determined by the Rector, or Proceeding indexed to Scopus.

k. Judicium and Graduate Predicate

Judicium is held when the students complete all academic and administrative requirements:

1. Completing course activities, thesis and other academic assignments with GPA ≥ 3.0 during the given period of study.
2. The minimum course score is C, with a minimum Thesis score of B.
3. Completing other requirements set by the study program.

   Graduate students will receive the following predicates:

   1. Graduating with Compliment (Cumlaude) predicate, with the following terms:
      a. GPA of Courses and Elective Courses (supporting thesis)> 3.75
      b. The thesis score is A
      c. Publishing the Thesis research in more than one article in scientific publications, in the form of proceedings and or international scientific journals indexed by Scopus or Web of Science Core Collection, accredited national journals or minimum status of Sinta 2, and Universitas Brawijaya journals appointed by the Rector.
         1) The maximum period of study is five semesters.
         2) No C score(s)
   2. Graduating with Very Satisfactory predicate, with the following terms:
      a. Does not complete other requirements on Compliment predicate
      b. GPA> 3.5 (for overall courses and thesis)
   3. Graduating with Satisfactory predicate, with the following terms:
      a. Achieving GPA: 3,0 < GPA < 3,5

b. The graduate predicate is determined by Thesis Final Examination Committee and approved by the dean, to be announced at Judicium.

4. Fail, with the following circumstances:
   a. GPA <3.0 for each semester (according to Course Plan Statement and Statement of Mark), or
   b. Fail at the Thesis proposal examination.
   c. Fail at the Thesis examination or exceeding the period of study and unable to complete the course credit.

2.6.3 Doctoral Program

a. Scope and Status of Dissertation

1. The dissertation is an academic paper resulting from independent in-depth and comprehensive research and contains new contributions to the development of science and/or technology conducted by doctoral candidates under the supervision of Promotors.
2. A dissertation is a Final Assignment to be completed by each Doctoral student at Brawijaya University.

b. Dissertation Objectives

1. The objective of preparing a Dissertation is to encourage the students in describing, analyzing, and synthesizing studied facts/phenomena or the results of in-depth study on mathematical theories and/or designs and applying them into mathematical models and/or new designs of their own, or modifying/developing theoretical mathematical models, and/or pre-existing designs and proved in compliance with scientific principles.
2. Research is a rule-abiding activity attempting to find the truth and/or solve problems in science, technology and/or art.

c. Activities in Obtaining Data

1. Data used as a basis for preparing a Dissertation must be derived from research activities, such as surveys and/or experiments with a statistical/mathematical approach, or

the results of in-depth study on mathematical theories/models according to their scientific fields.

2. Data must be obtained honestly and lawfully. Besides, it should not contain any element of plagiarism.
3. Terms of activity and research/study as referred to in point number 1 and 2 and procedures in obtaining data, preparation, systematic writing, etc. related to dissertation are organized in Handbook of Faculty administering Doctoral Program referred to the quality standard set by Postgraduate Program of Universitas Brawijaya.

d. Dissertation Credits

1. The dissertation comprises of 28 credits.
2. Dissertation credits are determined before the Dissertation Examination by the Dean of Faculty administering the Doctoral Program/Director of University's Postgraduate Program as proposed by Head of Doctoral Study Program.
3. Terms regarding Dissertation credits, requirements, stages of implementation and other related technical aspects are organized in Handbook for Faculty administering Doctoral Programs referred to quality standards set by Postgraduate Program of Universitas Brawijaya.

e. Content and Review/Understanding

1. The dissertation's substance is characterized by the development of science, technology, art, or humanities following the scope of the scientific field in the study program where students are registered.
2. Terms regarding substance and review/understanding of the dissertation are organized in Handbook of Faculty administering Doctoral Programs/Postgraduate Program of Universitas Brawijaya.

3. Dissertation in awarding an Honorary Doctorate Degree (Honoris Causa/HC) is stipulated separately by the Rector.

f. Requirements, Students' Rights and Responsibilities

1. Students may perform a series of Dissertation-related activities after completing academic and administrative requirements set by faculty administering the Doctoral Program and/or the University's Postgraduate Program.
2. A dissertation must be prepared following ethics and scientific manners, honesty and does not contain plagiarism. It must be referred to the Dissertation Writing Guidelines established by the faculty administering the Doctoral/Postgraduate Program of Universitas Brawijaya.
3. Promotor may use the Dissertation data as a source of material for publication in scientific journals/magazines or mass media in ethical and scientific manners.
4. All forms of the outcome, such as intellectual property rights, articles in scientific journals, etc. related to the material/substance of the dissertation are considered as cumulative rights among students, Promotors and the University.
5. In terms of collaborative research, the privilege of using data and intellectual property rights, etc. are organized in a cooperation agreement approved by the Dean of Faculty administering the Doctoral Program and/or Head of Postgraduate Program.
6. Terms related to the ownership and intellectual property rights resulting from the dissertation, as referred to in point number 4, will be separately stipulated by the Rector.

   Terms related to the requirements of students' rights and responsibilities, etc. as referred to in paragraphs 1 to 5 concerning Dissertation implementation, are stipulated by the Dean of Faculty administering the Doctoral Program.

g. **Qualifications of Promotors, Appointment, Rights and Responsibilities**

1. The dissertation is prepared independently by students under the Supervisory Commission's supervision, led by a Promotor assisted by 2 (two) or more Co-promotors.
2. The promotor has acquired at least an Associate Professor position with Doctoral qualification of the respective field of science or in a scientific sub-group relevant for the study program where the student is registered. The promotor acted as the main author and/or corresponding author of at least 2 (two) scientific works published in reputable international journals.
3. The Co-promotor has acquired at least Assistant Professor position with Doctoral academic qualification of the respective field of science or in a scientific sub-group relevant to study program where the student is registered and acted as the main author and/or the corresponding author of at least 2 (two) scientific works published in reputable international journals
4. Based on "specific considerations" and an agreement with the Head of the Study Program, students may propose one of the Co-promotors outside the Study Program in supporting their dissertation activities after completing the requirement mentioned in point number (3) and acquire level 9 of Indonesian National Qualifications Framework KKNI competence.
5. Promotors and Co-promotors are appointed by the Dean of Faculty administering the Doctoral Program/Head of Postgraduate Program as proposed by the Head of Doctoral Study Program.
6. Terms regarding qualifications, appointing procedures, rights and responsibilities of Supervisor are stipulated in

the Faculty Handbook of Faculty administering the Doctoral program.

h. Qualification Examination

1. Qualification examination is conducted to assess the academic competency of doctoral candidates. A candidate is permitted to conduct a qualification exam after completing a minimum of 12 credits of the study with GPA min. 3.0 and no score below B.
2. The qualification examination is conducted before preparing the dissertation. Passing this qualification examination is a prerequisite for preparing a Dissertation proposal.
3. The students are assigned to conduct independent scientific work to be considered "Dissertation pre-proposal" and consult the Supervisory Commission's work.
4. The Supervisory Commission meeting shall be conducted between the Supervisory Commission and the student (s) before executing the Qualification examination to meet the agreement regarding pre-proposal research. After having approval from the Supervisory Commission, the students may propose the qualification examination.
5. The qualification examination is performed orally, and the Supervisory Commission and Examiners perform the assessment.
6. The Examiner has acquired at least an academic position as an Assistant Professor with a Doctoral degree, and the number of Board of Examiners is 2 for each student.
7. Minimum Graduate Standard for Qualification Examination is 70 or equal to B score.
8. Students who fail at qualification examination are given the opportunity for a maximum of 1 (one) time to retake the examination.

9. The components and credits of qualification examination assessment consist of (a) Mastery of research methodology, (b) Mastery of subject in the area of study, (c) Ability of using logical thinking and performing abstract, systematization, and formulation of ideas; both in written and oral and (d) Ability to communicate scientific idea in writing and verbally within discussions.

Table 2.6 Percentage Standard of Assessment Component for Qualification Examination

No.	Assessment Component	Score (%)
1.	Mastery of research methodology	30
2.	Mastery of the area of study	30
3.	Ability in using logical thinking, performing abstract, systematization and formulation of ideas, in written and oral form	20
4.	Ability in communicating scientific ideas in a written and oral form within the discussion	20
Total		**100**

i. Research Proposal Examination

After passing the qualification examination, the student may proceed with the writing of the dissertation research proposal. The approved pre-proposal can be developed into a Dissertation research proposal, containing a research plan as the Doctoral program final assignment. Consulting with the Supervisory Commission is a must to meet the agreement regarding the research between students and Promotors.

Students may proceed with their Dissertation proposal examination after getting approval from the Supervisory Commission. Students arrange the administrative requirements for the Postgraduate

Administration section of the Faculty of Agricultural Technology. Head of Study Program appoints 3 Examiners as proposed by the Supervisory Commission. Each Examiner has acquired a minimum of a Doctorate as an Assistant Professor and equal competency to the respective research topic. The dean will appoint the Examiners.

Student and Supervisory Commission have conducted a Research proposal meeting minimum once before the Proposal Examination. The purpose of the meeting is for the Student and Promotors to agree on the Dissertation research's research topic and scope.

The Dissertation Proposal Examination is conducted according to the followings:

1. The Dissertation proposal examination is conducted publicly and must be attended by the Supervisory Commission and 3 Examiners.
2. Dissertation Examination assessment includes Dissertation research proposal manuscripts, mastery of research methods, mastery of theories relevant to the research topic, and the ability to use logical thinking, writing abstract, systematic thinking, and formulating ideas.
3. The score for the Dissertation proposal examination is the average score attained from Supervisor Commission and Examiners.
4. Students pass the exam when they obtain an average minimum B score. Students who have not passed the examination are allowed to retake the examination once.

Table 2.7 Assessment component for Dissertation proposal examination

No	Assessment Component	Score %
1.	Research proposal manuscripts	30
2.	Mastery of research methodology	30
3.	Mastery of theories relevant to the research topic	20
4.	Ability in using logical thinking, abstraction, systematic thinking and formulating ideas	20
	Total	**100**

j. Research and Research Progress Seminar

Student research activities produce research data that are publishable in national/international scientific seminars or reputable international journals and/or accredited national journals and can be used to prepare the student's dissertation. Assessment of the Dissertation research practice is performed by all Supervisory Commission members (Promotor and Co-promotor) based on applicable rules.

Based on Rector's Regulation 52/2018, the Seminar result is considered one component of completing the dissertation. Students may conduct research results Seminars when they are considered to acquire appropriate data by the Supervisory Commission. In taking a Doctoral Program of Food Science, students are required to conduct research Seminars 3 times. The result Seminar may not be compulsory for a student participating in national or international seminars as oral presenters under the Supervisory Commission's approval. In this case, the students are required to submit certificates and proceedings to the Supervisory Commission and Head of Study Program.

Terms and Procedure:

1. Students conduct the dissertation research seminar after obtaining approval from the Supervisory Commission.
2. A seminar on research results is held publicly.
3. The research result Seminar is written according to article format for scientific publication. The Seminar paper must be approved and signed by the Supervisory Commission.
4. Students copy the seminar abstracts up to 20-25 copies.
5. Students must revise the draft publication based on suggestions from the Supervisory Commission.

Table 2.8 Component of Result Seminar Assessment

No	Assessment Component	Score %
1.	Article manuscripts quality	2
2.	Originality, up to date, analysis strength	20
3.	Mastery of research methodology and science substance	30
4	Ability in delivering scientific arguments	30
Total		**100**

k. Monitoring Research Practice

Monitoring of research practice is performed through (1) Research Control Sheet, (2) Dissertation Research Logbook, (3) Dissertation Progress Report, and (4) Supervision on the Research practice.

1. Research Control Sheet
    a. The research control sheet contains brief information on research progress regularly (weekly).
    b. Research Control Sheet is kept by the students to be consulted and completed periodically (monthly) to the promotor.
    c. The promotor signs the Research Control Sheet periodically during supervisory activities.
    d. The Research Control Sheet shall be fully completed by the student and signed by the promotor.
    e. Completion of Research Control Sheet (point 1.4) is one of the requirements in registering for research Result Seminar

2. Dissertation Research Logbook
    a. The logbook contains brief notes/information on research activities conducted by the students and notes by the Promotors related to the research problems/issues that might be faced by the student, which is updated regularly.

b. Logbooks may be filled with notes/information related to literature analysis conducted by the Students.
c. This logbook is kept and filled by Students and is regularly consulted and informed to the promotor.
d. The promotor signs the logbook periodically during supervisory activities.
e. Completion of the logbook (point d) is one of the requirements for registering research Seminar results.
f. Students may take the logbook in the academic section by showing a statement of passing the Dissertation proposal Examination.

3. Dissertation Progress Report
   a. Students conducting the Dissertation learning process are required to write a progress report on the research process at midterm and the end of each semester.
   b. Dissertation Progress Reports comprises of (1) Progress Report on the research, (2) Progress Report on Management and Data Analysis, (3) Progress Report on Preparation of Seminar Papers and Dissertation.
   c. The progress report contains the following information:
      1) Student Identity
      2) Dissertation Title
      3) Supervisory Commission and Examiners
      4) Dissertation Schedules
      5) The substance of the Progress Report includes:
         a. Completed activities and the results of activities to be written into any scientific articles when possible.
         b. On-going activities and deadlines.
         c. Activities to perform and the timeline.
         d. This progress report must be approved and signed by the promotor.
         e. This progress report is addressed to the Head of the Doctoral Program.

f. Preparing 5 copies of the progress report, each to be distributed to Students, Promotors, Co-promotors 1, Co-promotors 2, and the Head of Doctoral Program.
g. The progress reports are submitted to the academic department and students will receive a statement of receiving the progress reports.
h. The Progress Report may be submitted at any time.
i. The promotor will use the Progress Report as one of the considerations in assessing the Dissertation research implementation.
j. This Progress Report will be used by the Head of the Doctoral Program to monitor the Dissertation learning process of the students.

4. Supervising Research Practise.
   a. Dissertation Research Supervision is conducted on research using experimental methods performed in the laboratory, greenhouse and/or in field.
   b. Supervision is not conducted on Dissertation research using the survey method unless there are special considerations.
   c. Research supervision is conducted to (1) assure whether the research practice in line with the research proposal and (2) find solutions to problems faced by students in conducting their research in the laboratory and/or field.
   d. Research supervision is conducted one time by Promotor or Co-promotor appointed by the promotor as his/her representative.
   e. The Supervisor who will supervise the research will be responsible for supervising reports and assessments on the research practice.
   f. The Research Supervision Report contains the following information:
      1) Identity of the student and Supervisors.
      2) Dissertation Title.

3) Title/on-going research activities
4) Problems faced by students in conducting research.
5) Documentation of research practice.
6) Other necessary information
7) Funding for research supervision is paid by Students, as stipulated by the Dean's Decree / Head of Postgraduate Program.

5. Quality Assurance Team of Dissertation

The dean assigns the quality assurance team of the dissertation on the recommendation of the Head of the Study Program. This team functions to ensure the dissertation's quality is feasible from the proposal exam to the final dissertation report. Students will pass if the Quality Assurance Team of Dissertation has examined the quality of the dissertation. The study program further regulates the Dissertation Quality Assurance Team.

a. Quality assurance team of the dissertation is an *ad hoc* team formed to assess the feasibility of the dissertation
b. The team is a representative of the scientific field (laboratory) lecturers in the study program and is proposed by the Head of the Doctoral Study Program to the dean and determined based on the Dean's Decree
c. Dissertation Quality Assurance Team has 2 years of the working period; after that, a new Dissertation Quality Assurance Team is re-formed.
d. Quality Assurance Team of Dissertation has the following requirements;

1. The functional position of Professor or Head Lector

2. Having experience of one publication on a reputable international journal (minimum Q3)

l. Scientific Publication

According to the regulation of UB's Rector No. 52, 2018, each Doctoral Program student is required to take and complete Final Assignments in the form of Dissertation and Scientific Publication, in which the Scientific Publication is based on the results of Dissertation research:

1. 2 (two) scientific articles in International Scientific Journal indexed by Scopus or Web of Science Core Collection (Thomson Reuter), acquire the lowest impact factor of 0.1, or Microsoft Academic Search; or
2. 1 (one) scientific article in a scientific journal as referred to point (a) and 1 (one) article in the form of Proceeding. The student has to be the first author on one of the Scientific Publications.

Students are required to consult with the Supervisory Commission regarding the scientific journals' name to be addressed and research results to be written in the journal. During their study, students are required to publish research results in scientific journals in the form of 2 articles based on UB Rector's Regulation No. 52, 2018. Two credits will be given on each publication. The assessment of article quality is determined by the Assessment Team of the Faculty of Agricultural Technology.

m. Evaluation of Dissertation Feasibility by Supervisory Commission

1. Requirements for Dissertation feasibility examination are as follows:
   a. Has passed seminar on research results
   b. Has performed revision on Dissertation manuscripts
   c. The Dissertation paper has been approved by the Supervisory Commission and has completed the administrative requirements.

2. Dissertation feasibility examination is attended by at least Promotor and Co-promotor, 2 Examiners, and 1 Reviewer.
3. Procedure in conducting Dissertation feasibility examination:
   a. Students propose the feasibility Examination to the Head of the Doctoral Program.
   b. Students register to the academic department and obtain administrative requirements for the Dissertation feasibility examination.
   c. The Supervisory Commission proposing the reviewer and schedule for Dissertation feasibility exam to the Head of Study Program
   d. The Head of Study Program appoints the reviewer and schedules for the Dissertation feasibility examination.
   e. The examination will be conducted in close and held for 90-120 minutes.
   f. After completing the examination, the promotor submits the scoring record to the academic department for further processing.
4. Assessment on Dissertation Feasibility Evaluation
   a. Each attending lecturer (including Promotor and Co-promotor) will have to conduct an assessment.
   b. The chairperson (Promotor or Co-Promotor) collects the assessment results from all lecturers, recapitulates and calculates the average scores. This average score represents the Dissertation Feasibility Score, and the Dissertation Feasibility score is expressed in the form of Quality Numbers and Quality Letters. The minimum passing score for the Dissertation Feasibility assessment is B (> 70).
   c. Recapitulation of the assessment is signed by the Chairperson (Promotor and Co-Promotor).

5. Suggestions from the Dissertation Feasibility Evaluation.
    a. The suggestions from each lecturer are written in the "suggestion sheet" provided by the academic staff of the Study Program.
    b. The forum agrees and decides appropriate suggestions for the students in improving their dissertation manuscript.
    c. Students are required to revise their dissertation scripts while consulting with the promotor and/or Co-promotors. The students may also consult with competent lecturers when necessary.
    d. The Supervisory Commission is responsible for the revision of the Dissertation manuscripts based on agreed suggestions.

n. Dissertation Final Examination

1. Requirements
    a. The Dissertation manuscripts have been approved and signed by all Supervisors (Promotor and Co-promotors).
    b. Having completed all administrative requirements based on applicable regulations.
    c. The Dissertation manuscripts have been approved and signed by all Supervisors (Promotor and Co-promotors).
    d. The Supervisory Commission has assessed the feasibility of the Dissertation manuscripts.
    e. Having completed all financial requirements based on applicable regulations.
    f. Registering for the final Dissertation Examination in the academic section. Registration is conducted 10-15 days before examination day.
2. The Dissertation Final Examination Commission consists of:

a. Chairperson (Dean/Director/person appointed as representative).
b. A Promotor and Co-Promotor (2 people).
c. Dissertation Assessment Commission (Examiners) (3 people).
d. An External Examiner (Guest Examiner) who is an expert in the respective field and invited from outside of Universitas Brawijaya.
e. Guest Examiners are proposed by the promotor to the Head of Doctoral Program and appointed with the dean's decision letter.
f. Open dissertation examination may be conducted with a minimum of two attendees of the Supervisory Commission (Promotor and/or Co-promotor), two people from the Dissertation Assessor (Examiner) and/or an External Examiner. In the case of irrelevance, it requires special approval from the Head of the Doctoral Program.

3. Completion of revised Dissertation
   a. After passing the final Dissertation Examination, the student will be given 4 (four) weeks for revision (if any).
   b. The revised Dissertation manuscripts were signed by the Supervisory Commission and Head of Doctoral Program and subsequently submitted to the Postgraduate Program of the Faculty of Agricultural Technology.
   c. If the student has not submitted the Dissertation manuscript to the postgraduate academic section of the Faculty of Agricultural Technology within 4 (four) weeks, the dissertation score will be deducted by one level.
   d. If the student has not submitted the Dissertation manuscripts within 8 (eight) weeks, he/she must

retake the Dissertation Examination, and funding is to be paid by the student.

o. Assessment for Dissertation Learning Outcomes

1. In case the dissertation's material/substance consists of several sub-studies, they must constitute an integrated research work that is interrelated or sequential.
2. Student learning outcomes in the dissertation's implementation are assessed through preparing proposals, implementation, reporting, scientific articles/papers and examinations.
3. The research forms in each phase of the dissertation are stipulated in the Faculty's Handbook administering Doctoral Program/University Postgraduate Program.
4. Based on Rector Regulation, 2018, Article 4, regarding Dissertation and Scientific Publication, students must use the material/substance of the dissertation to prepare 2 (two) scientific articles in reputed International Scientific Journal (indexed by Scopus or Web of Science Core Collection (Thomas Reuters) or 1 (one) scientific article in a reputed International Scientific Journal and 1 (one) article in a Scopus indexed proceeding, and students are required to prepare a Dissertation to be assessed by the Board of Examiners.
5. In case the student is awarded an A score without final examination, the student is required to produce two scientific articles published in Scopus International Scientific Journal or Web of Science Core Collection (Thomas Reuters). The requirement for the journals is that the journals have the lowest impact factor of 0.20. The average score of all Examination stages / Seminar Dissertation is A, and Dissertation manuscripts have been evaluated and approved by The Commission and disseminated in scientific forums of Faculty / Postgraduate Program.

6. The promotor proposes students with A score without final examination to the Dean / Head of Graduate Program.
7. The dissertation assessment component includes (a) Research proposal, (b) Specific Task in supporting the dissertation, (c) Research practice, (d) Dissertation writing, (e) Scientific publication, (f) Result seminar, and (g) Dissertation Examination.

p. Judicium of Doctoral Program

Judicium may be conducted when the Students complete all academic and administrative requirements, such as:

1. Has fulfilled all academic requirements (courses and academic assignments) and administrative requirements and pass the final examination.
2. GPA> 3.00 during the study period.
3. Completin other requirements set in the study program.

q. Graduate Predicate for Doctoral Program

Graduated students receive the following graduate predicates:

1. Graduated with "Compliment" (Cumlaude) predicate, with the terms:
   a. GPA of Dissertation Courses and Dissertation Supporting Courses > 3.75, without score B.
   b. Score A for Dissertation.
   c. Publishing Dissertation research results in more than one International Scientific Journal articles with impact factors indexed by Scopus, the Web of Science (at least having article acceptance letter).
   d. The maximum period of study is eight semesters.
2. Graduated with "very satisfactory" predicate, with the terms:
   a. Does not meet the requirements in paragraph (1) and,
   b. Achieve 3.50 <GPA ≤ 3.75 (all courses and dissertation)
3. Graduated with "Satisfactory" predicate, with the terms:
   Achieve 3,00 ≤ GPA ≤ 3,50 (all courses and dissertation). This graduate predicate is determined by the Dissertation

Final Examination Commission, approved by the dean, and announced at Judicium.

2.6.4. English Class Program

English class program uses English as a language of communication in teaching and learning activities, including fulfilling structured tasks and tests. The implementation of the English class is begun in the 2nd semester. Only students who have passed the selection are able to join the English class. The test selection is carried out every first semester.

Students' Rights in the English Class

1. After the student has passed the class, students receive a certificate stating that the student concerned came from the class using English as a communication language.
2. The requirement to take part in student exchanges, such as joint research students, internships, short courses, double degree programs, and others performed abroad, is that the students must come from classes with English as communication.
3. Students have the opportunity to take part in the short course/summer course held by FTP UB

Implementation of the English Class

1. Selection is carried out in the 1st semester for study programs that hold English classes.
2. Selection is in the form of a written exam, which is compulsory for all 1st-semester students in study programs that hold English Class
3. Students who have passed the written test are required to follow an interview selection conducted by the Head of the Study Program and/or the department's chairperson.
4. Students who have passed the selection test will be offered to join the English class and make a statement of willingness to complete the English class.

Rules for the English Class

1. Students who have been registered in an English class are not allowed to change the classes

2. In compulsory conditions, students are allowed to submit resignation from the English class and move to the regular class with the following conditions:
   a. Showing evidence of a decline in the Achievement Index score in two consecutive semesters (two semesters that show a decreased GPA)
   b. Losing rights as an English class student
   c. Making a written letter of inability to take classes in English with the knowledge and signatures of the student concerned, parents, academic supervisors, and the head of the study program
   d. Submitting his resignation to the Vice Dean for Academic Affairs of FTP UB
3. If a student is transferred to a regular class without submitting a resignation letter, the faculty will transfer the student concerned back to the English class.
4. Thesis and Field Practise (PKL) reports are allowed to be written in English

2.6.5 Double Degree Program

Double Degree education program is an educational program that provides 2 (two) certificates from UB and overseas universities that are partners of UB, for students who have met the requirements.

a. Students

1. Students for the Double Degree Education Program are members of the public who are registered as active students in the Bachelor, Master, or Doctoral program at UB.
2. Prospective students must follow and pass the selection as students in the Double Degree Education Program.
3. The selection system, which contains requirements, procedures, graduation, and foreign universities that become partners, is determined by the Rector.

b. Requirements

1. Students must be registered as active students in the study program during compulsory academic activities in UB at the chosen level that organizes the Double Degree Education Program.
2. Students must be registered as active students in the specified study program during compulsory academic activities in other universities abroad that are partners of UB.
3. All consequences of academic administration as a result of participation in the Double Degree Education Program are following applicable regulations.

c. Finance

Students are required to pay all forms of payment obligations related to the Double Degree Education Program following applicable regulations.

d. Curriculum

1. Double Degree Education Program students must take a curriculum that has been determined by the study program at the chosen level at the university.
2. The faculty/program leader proposes to the Rector the requirements and education curriculum that must be completed in UB before students are allowed to study in the Double Degree Education program set by UB and overseas universities that are partners with UB.
3. Students must pass the academic and/or administrative requirements set by the partner universities abroad.
4. Double Degree is included in a regular class.
5. To get 2 (two) certificates, students must pass all academic obligations and complete administrative requirements at the level of education chosen in the Double Degree Education Program set by UB and overseas universities that are partners with UB.

e. Certificate and Degree

1. Certificates from 2 (two) study programs at UB and other universities abroad that are partners are given to students who have completed all the Double Degree Education Program curricula at the level chosen legally and according to the provisions.

2. Designations of degrees from other foreign universities that are partners follow the designation rules imposed by the university.

2.6.6. Credit Transfer

Credit transfer is a class program implemented partly in other universities. Classes held in other universities are approved as credits that can be converted into credits with the same subject.

2.6.7. Joint Supervision

Research implemented outside the University of Brawijaya, either in research center or other universities can be guided by other supervisors from outside the University of Brawijaya. The supervisors become co-supervisors with the main supervisors come from FTP UB. The co-supervisors must follow the final project implementation process, such as mentoring, proposal seminar, and final test. If the FTP UB students help the research projects of lecturers/researchers outside UB, the study programs and departments must evaluate research partners' satisfaction as material for evaluation and improvement of future research collaborations.

2.6.8. Disabilities

"Students with disabilities are those who have impairments so that they need special aids, environmental modifications or alternative techniques to be able to participate in the learning process and other academic activities and have the same opportunities as other students to succeed" (Directorate General Higher Education, 2012).

The following is an explanation of the obligations that students must carry out with disabilities and also the rights that students must obtain with disabilities in education:

Obligations of Students with Disabilities

1. Doing the assignments and assignments of new students' orientation program independently
2. Independent in mobility from home (boarding house) to campus

3. Participate in lectures and new students' orientation program with discipline
4. Fill out the attendance card (attendance list) companion

Rights of Students with Disabilities

1. Get assistance during lectures, do college assignments, new students' orientation program, and take care of lecture administration
2. Obtain a replacement companion if the primary companion is not available
3. Obtain clear information about assignments and other lecture activities
4. Obtain lecture materials in an accessible format according to the needs of students with disabilities
5. Get fair service
6. Refusing to be accompanied because they feel independent
7. Propose a substitute companion if not feel uncomfortable with the companion who has been appointed as a companion
8. Accompanied by someone other than the companion

2.7 EVALUATION ON STUDY SUCCESS

2.7.1 Undergraduate Program

a. Evaluation of Final Semester Study Success

Evaluation of final semester study success is conducted at the end of each semester, including courses taken by students during the semester. Results of this evaluation are mainly used to determine course credits for the following semester under the following conditions:

b. Evaluation of First-Year Study Success

Evaluation of first-year study success is an evaluation conducted after students completed two cumulative semesters (excluding academic leave). Students may proceed with the next courses under these requirements:

1. Having completed at least 20 credits.

2. GPA at least 2.00 of a total of 20 credits taken from the best scores.
3. Fulfill requirements determined by the faculty.

c. Evaluation of Second-Year Study Success

Evaluation of second-year success is an evaluation conducted after students completed four cumulative semesters (excluding academic leave). Students may proceed with the next courses after the second year, under these requirements:

1. Having completed at least 48 credits.
2. GPA at least 2.00 of a total of 48 credits taken from the best scores.

d. Evaluation of Third-Year Study Success

Evaluation of third-year study success is an evaluation conducted after students completed six cumulative semesters (excluding academic leave). Students may proceed with the next courses after the third year, under these requirements:

1. Having completed at least 72 credits.
2. GPA at least 2.00 of a total of 72 credits taken from the best scores.

e. Evaluation of Fourth-Year Study Success

Evaluation of fourth-year study success is an evaluation conducted after students completed eight cumulative semesters (excluding academic leave). Students may proceed with the next courses after the fourth year, under these requirements:

1. Having completed at least 96 credits.
2. GPA at least 2.00 of a total of 96 credits taken from the best scores.
3. Final assignment will be evaluated each semester using a mechanism established by each faculty.
4. Each faculty organizes the evaluation of Transfer Program students.

f. Evaluation of Undergraduate Program Final Study Success

Total credit to complete an undergraduate program is 144-160 credits, including bachelor thesis/other assignments. Each department determines the minimum number of credits. Students who have completed the minimum number of credits will be proclaimed to have completed an undergraduate study program under these requirements:

1. GPA of at least 2.00.
2. D/D+ scores do not exceed 10% of total credit, except Civic Education and Religious Education courses must not score D/D+
3. There is no E.
4. Pass the undergraduate examination with a minimum C.

In case a GPA is less than 2.00, the student must improve the score by retaking the course within the study period, which conducted in the following semester offering the course. The score evaluated will be the best score.

For undergraduate transferred students from Diploma-III, the maximum period of study at Universitas Brawijaya is four years, from Diploma-II is five years and from Diploma-I is six years. For transfer students, the study period from the previous College is not considered a period of study. Vice Dean of Academic Affairs evaluates study success at the end of each academic year. The evaluation of study success is summarized in the following table:

Table 2.9 Evaluation of study success

Year	Min Credits	Min GPA	Sanction
1	24	2.00 of 20 best credits	Warning Letter
2	48	2.00 of 48 best credits	Drop out (DO)
3	72	2.00 of 72 best credits	DO
4	96	2.00 of best 96 credits	DO
Final Study	144-160	2.00	For GPA < 2.0, score improvement is necessary. Special examination may be conducted under

Year	Min Credits	Min GPA	Sanction
			certain conditions.

2.7.3 Master Program

The Master Program Education is provided for students with a Bachelor/Undergraduate degree and designed with four semesters (2 years). The program may be taken in less than four semesters and a maximum of eight semesters (4 years). The student who exceeds the four years of study without reasonable reasons will be proclaimed to fail.

The period of study excludes academic leave (terminal). Each student is entitled maximum 2 (two) semesters of academic leave during their period of study, under these conditions: (1) long-term sickness/illness and impossible to join the learning process, (2) maternity leave, (3) domiciled in a place which is impossible to perform learning process, (4) other acceptable conditions approved by the Head of Postgraduate Programs.

a. Fail

Students are proclaimed to fail under the following conditions:

1. GPA < 3.0 in each semester.
2. Do not pass the thesis proposal examination.
3. Do not pass the thesis examination.
4. The period of study is expired and has not completed the course credits following applicable regulations.

b. Evaluation of Success

1. Students who have not reached a minimum GPA of 3.00 for the eight best credits at the end of the first semester will be given a warning notice to improve their study in the following semester.
2. Students who fail at reaching GPA of 3.00 for the best 16 credits in the second semester, the student will be proclaimed to fail and may not proceed with their study.
3. Courses with score D must be retaken and C can be retaken. Retaking certain courses can only be done once and the maximum score is B.

4. For students who have taken a minimum of 24 credits with a minimum GPA of 3.00 without a D, they may formally submit their thesis research proposal.
5. The thesis research proposal must be approved by the Supervisory Commission and Research Proposal Assessment Team (Supervisory Commission and two examiners appointed by the Head of Postgraduate Program based on the proposal of the Head of Study Program).
6. Students may immediately proceed with their thesis research after passing the research proposal examination and having the revisions approved by the Supervisory Commission.

2.7.3 Doctoral Program

a. Fail

Doctoral students are proclaimed to fail the study under certain conditions as follows.

1. GPA < 3.00 for the whole courses (based on KRS and KHS) evaluated in semester 3, or
2. Do not pass Qualification Exams, or
3. Do not pass the Dissertation Proposal Exam, or
4. Do not pass Dissertation Exam, or
5. Unable to complete the course credits within the given period of study (period of study has been expired)
6. Do not re-register for 3 semesters

b. Evaluation of Study Success

Evaluation of study success of Doctoral Education Program is as follows:

1. Students who have not reached a minimum GPA of 3.00 for 12 best credits, at the end of the first semester will be given notice warning to improve their academic performance in the following semesters.
2. Students who achieve a GPA of 3.00 for 12 best credits at the end of the first semester may apply for a qualification examination in the second semester.

3. The course scored below A may be retaken in the following semester, not more than twice.

2.8 DEADLINE OF STUDY

2.8.1 Undergraduate Program

Undergraduate programs must be completed no longer than seven years, since the students registered as students of Universitas Brawijaya. The students will be dropped out if they are unable to complete the study within the given period of study.

The 7 (seven) years of study period excludes academic/terminal leave, and for students attempting academic leave without Rector's approval, the period of leave will be considered as a period of study and deduct the student's period of study. Each student is entitled to a maximum of 4 (four) semesters to leave during the period of study. Students may attempt academic leave under certain conditions (1) long-term sickness/illness and impossible to perform learning process, (2) maternity leave, (3) domiciled in a place which is impossible to perform learning process, (4) other acceptable conditions approved by the Head of Undergraduate Program.

2.8.2 Master Program

Credit for master program is a minimum of 36 credits, including master's thesis. Master Program (for participants with a bachelor's/undergraduate degree) is designed within a 4 (four) semester study, may be taken in less than 4 (four) semesters, and maximum 8 (eight) semesters (4 years). Students who cannot complete their study within 4 (four) years without acceptable reasons, the student will be proclaimed to fail the master program. The study period excludes academic leave (terminal), and each student is entitled to academic leave for a maximum of 2 (two) semesters during their period of study.

Students may attempt academic leave under certain conditions (1) long-term sickness/ illness and impossible to perform learning process, (2) maternity leave, (3) domiciled in a place which is impossible to perform learning process, (4) other acceptable conditions approved by the Head of Postgraduate Program.

2.8.3 Doctoral Program

Doctoral Program requires students with a Master's Degree level to complete a minimum of 42 credits within 6 (six) semesters and or less with a maximum of 14 (fourteen) semesters period of study. Students with a Master's Degree level outside the respective program will require to complete min 52 credits within 5 (five) semesters or less than 6 (six) semesters with a maximum period of 14 (fourteen) semesters period of study. Students attempting to apply for dissertation exam after completing five semesters of course study requires approval from the Doctoral Committee in terms of assessing the student's feasibility, ~~in~~ which measured by the number of international scientific publications in Q3 that have been published, quality of published articles and journals, and as other achievements that support the student academic program.

2.9. FREEDOM TO LEARN PROGRAM

The policy of Freedom to Learn – Freedom Campus according to Permendikbud Number 3 of 2020 concerning the National Higher Education Standards, Article 18 states that the fulfillment of the period and study load for students of undergraduate or applied undergraduate programs can be carried out: 1) following the entire learning process in the study program at higher education according to the period and study load; and 2) following the learning process in the study program to fulfill part of the learning period and load and the rest follow the learning process outside the study program.

Through the Freedom to Learn - Freedom Campus, students have chances for 1 (one) semester or equivalent with 20 (twenty) credits take learning outside the study program at the same Higher Education institution; and a maximum of 2 (two) semesters or equivalent to 40 (forty) credits of studying in the same study program at different higher education institutions, learning in different study programs at different higher education institutions; and/or learning outside the university.

The implementation of Freedom to Learn - Freedom Campus is implemented in a~~n~~ Freedom Curriculum. Not all students are obliged to take the freedom curriculum/ freedom to learn. This curriculum is applied to students who are interested. Cost consequence incurred due to the implementation of this freedom curriculum is borne by the students. This Freedom Curriculum in FTP is conducted by the Freedom to Learn – Freedom Campus Guidelines of the Minister of Education and Cultures as well LP3M UB consisting of two parts:

1. Learning outside the study program at the University of Brawijaya, which consists of 20 credits
2. Learning with 40 credits which are carried out by taking 1 or 2 choices from the 8 choices provided in Freedom to Learn – Freedom Campus, namely:
    a. Internship/Work Practice
    b. Teaching Assistance in an Educational Unit

c. Research
d. Humanitarian Project
e. Entrepreneurial Activities
f.Independent Project/Study
g. Building Villages / Thematic Community Service Program (KKNT)
h. Student Exchange

Figure 2.1. Choices in Freedom to Learn – Freedom Campus

In general, the equalization of the load of the Freedom to Learn – Freedom Campus activities can be grouped into 3 forms, namely:

1. Freeform based on the distribution of the Learning Outcomes
2. Structured form based on the equivalent of courses
3. Blended form (a combination of 1 and 2).

III. ADMINISTRATION OF EDUCATION SYSTEM

3.1 IMPLEMENTATION OF CREDIT SYSTEM ADMINISTRATION

Credit system administration is performed under several stages for each semester:

3.1.1. Preparing Registration

Preparation of registration includes:

a. List of Academic Supervisors and supervisees
b. Instruction guide and registration cards:
   1. Academic Registration Sheet (KRS)
   2. Revised Study Plan Sheet (KPRS)
   3. Study Result Sheet (KHS)

3.1.2. Completing online KRS

Procedures in completing online KRS:

a. Collecting registration documents

Students visit the Academic Division of Faculty of Agricultural Technology to take registration documents by showing a valid Student Identity Card.

b. Arranging Semester Course Plan

The appointed Academic Supervisors will assist students of Universitas Brawijaya in arranging their semester course plan. New students are required to take predetermined course credits for the first semester. The following semester's course plan will be based on the previous semester's academic achievement, while the credits will be based on the GPA of the previous semesters. Students are required to input their course plans into SIAKAD, print the academic registration (KRS) approved by Academic Supervisor, and submit it to the Academic Sub Division of Faculty of Agricultural Technology, Universitas Brawijaya.

c. Revising Study Plan

Revising the study plan means to replace one course with another in the same semester and executed no longer than the end of the second week since learning activities begin. It must be approved by the Academic Supervisor and immediately reported to the Academic Sub Division of Faculty of Agricultural Technology.

d. Course Cancellation

Course cancellation means canceling the course plan and will not be assessed during the respective semester. The course cancellation may have proceeded no longer than the second week of the first week of the semester. The course cancellation may be executed with the approval by Academic Counselor and to be submitted to the Academic Sub Division of Faculty of Agricultural Technology.

e. Study Results

Study results are scores achieved by students for all courses as written in Academic Registration (KRS) and Study Result Sheet (KHS).

3.1.3. Courses, Seminars, Practices, etc.

Students must join courses, seminars, practices, and other academic activities as written in their course plan following the applicable regulation.

3.1.4. Course Exams

Procedures in administering course exams:

a. Arranging Examination Schedule

Schedules must be carefully arranged following the academic calendar, midterm, and final examination before announcing them to the students and lecturers.

The exam schedule is announced no later than a week before the examination day to allow students and lecturers to arrange necessary preparations as early as possible. Examinations, courses, and practicum are arranged together. Committee appointed by the Dean organizes midterm and final examinations.

b. Examinations

Students may conduct the examinations after completing a minimum of 80% of course activities in the respective semester and other requirements. Students who complete less than 80% of course activities are not entitled to conduct the Final Examination. However, other assessment components are considerable. The result of the examination will be announced to the students in the form of the final score and other components such as midterm examination, practicum, and quiz scores etc.). Violation in examination (cheating, completing other students' examination, and or students whose examinations are completed by other students) will result in examination cancellation of all courses in the respective semester.

3.1.5. Administration Score

a. Study Result Card (KHS)

The examination results must be input online in SIADO (Lecturer Information System) by supporting lecturers to be used as a reference in arranging KHS and KRS for the following semester by Academic Subdivision. KHS will be printed into 4 (four) copies distributed to students, parents/guardians, Academic Departments, and Subdivisions.

b. Archiving Student Examination Results

Archiving student examination results is carried out by the Academic Subdivision of the Faculty of Agricultural Technology. Student exam results data need to be stored are:

1. List of student examination results for each course.
2. KHS includes the cumulative score of the student's examination results each semester and their achievement index.
3. Cumulative scores for all courses from the first semester to the semester concerned.
4. The documents must be completed with all assessment tools. The documents also must be archived in the department administration.

3.2 STUDENT REGISTRATION

3.2.1 Objectives

a. To control the establishment of academic activities each semester.
b. To recognize the "student body" and the number of students who actively participate in academic activities for each semester.
c. To acquire data related to student activities and status.

3.2.2 Type of Student Registration

a. Administrative Registration

Administrative registration is an activity of obtaining registered status as a student of the Faculty of Agricultural Technology, Universitas Brawijaya. All administrative registration activities must be performed by students in an orderly manner at the beginning of each semester following academic calendar regulations.

1. Student Candidate Administration

a) Terms of Undergraduate Program Registration
   1) Each new student candidate must complete administrative registration by themselves.
   2) Submit a participant card for the entrance exam
   3) Bring the original graduation certificate and submit the copies.
   4) Bring the original report card and submit the copy.
   5) Bring National Examination Record and submit the copy.
   6) Bring Birth Certificate/birth certificate and submit the copy.
   7) Bring Certificate of Citizenship for foreign descent citizen and submit the copy.
   8) Submit Certificate of Health from Universitas Brawijaya Health Team.
   9) Complete the administrative registration form for student candidates and sign a sealed Statement Letter issued by Universitas Brawijaya.
   10) Submit tuition fee payslip and other payments under applicable regulations.
   11) Submit a copy of other necessary documents as required for registration.

b) Terms for Master Program Registration.
   1) Completing the administrative requirements for new students.
   2) Completing all academic requirements, bring required original files and submit copies of:
      - Bachelor Certificate (S1) Grade Point Average> 2.75 on scale 0-4) or> 6.25 (scale 0-10).
      - Academic Potential Test of OTO Bappenas with a minimum score of 450.
      - English Language Proficiency certificate which is equivalent to TOEFL with a minimum score of 475.
      - PAT certificates for students with a non-linear Undergraduate program.

c) Requirements for Doctoral Program Registration
   1) Completing all administrative requirements for a new student.
   2) Completing all the academic requirements, bring required original files, and submit copies of:
      - Master Degree Certificate with Grade Point Average> 3.50 on scale 0-4. If 3.00 <GPA <3.50 four scientific papers (journals, books, proceedings, or the like) will be required.
      - Academic Potential Test of OTO Bappenas with a minimum score of 500.
      - English Language Proficiency Certificate which is equivalent to TOEFL with a minimum score of 500.
      - PAT certificates for students with non-linear Master Program

d) Sanctions
   1) Each student candidate who does not complete the requirements will not be accepted as a student of the Faculty of Agricultural Technology, Universitas Brawijaya.
   2) Exceeding the administrative registration date is considered withdrawn.
   3) Providing false information will result in the cancellation of administration or withdrawal from the Faculty of Agricultural Technology, Universitas Brawijaya.
   4) There will be additional time for administrative registration.

2. Administrative re-registration for a former student

Requirements for undergraduate and postgraduate program re-registration.

Each former student must complete the re-registration process by themselves by submitting:

1) Administrative re-registration form which has been completed.
2) Student ID Card of the previous semester.
3) Tuition fee payslip for the previous academic year.
4) Tuition fee payslip for the respective semester / academic year.
5) Two photos, 3x3 cm.
6) Students who are not registered in the previous semester are required to have registration approval from the Rector.

a. Sanctions

1) Former students who do not conduct administrative registration in a particular semester will be proclaimed unregistered in the respective semester and will deduct their study period.
2) Former students who proceed with the administrative registration after the due date will be proclaimed as not registered as students of the Faculty of Agricultural Technology, Universitas Brawijaya.
3) Former students who are not registered, as stated in point 2, may submit their applications for academic leave to the Rector no longer than 1 (one) week after the administrative registration process is closed.
4) Former students who are not registered for 2 (two) cumulative semesters are considered withdrawn from the Faculty of Agricultural Technology, Universitas Brawijaya.
5) Former students of the Postgraduate Program are required to register on a predetermined schedule, for students who do not register in the ongoing semester will be withdrawn from the Faculty of Agricultural Technology, Universitas Brawijaya.
6) There is no additional time for administrative registration.

b. Academic Registration

Academic registration is conducted to enable students to perform certain semester academic activities.

1. Academic registration activities include:
   a) Completion and Approval on the Study Plan Sheet (KRS)
   b) Completion of the Revised Study Plan (KPRS)
   c) Course cancellation
2. Course plans counseling is performed between students and the Academic Supervisor (PA) following the academic calendar.
3. A student may apply for certain courses after completing the requirements and approved by the Academic Supervisor.
4. KRS that has been approved by the Academic Supervisor must be immediately submitted to the Academic Sub Division of Faculty of Agricultural Technology.

3.3 PAYMENT TERMS FOR TUITION FEE

3.3.1 New students

Each new student who is accepted at the Faculty of Agricultural Technology, Universitas Brawijaya through SBMPTN and SNMPTN, pays their tuition fee in the form of a Single Tuition Fee (UKT). While new students who are accepted through independent entrance are required to pay Educational Development Contribution (SPP), Development Contribution and Educational Facilities (SPFP), and other fees, the amount of which is determined by Rector's Decree. Those payments must be executed during administrative registration, where the SPP can be paid at once in one year or two times, in the first and second semesters. Meanhhile, the SPFP and SPIP fees and other fees are paid once during the first administrative registration for new students.

3.3.2 Former Student

a. Each student who has enrolled for administrative registration must pay tuition fees that can be paid once for a year or twice in the first and second semesters.
b. For students with inactive status and do not re-register for one semester without the Rector's approval, they are required to pay

the tuition fee (SPP) during their inactive period, in which the payment be executed during the re-registration process when the student attempts for re-activation status by submitting the active status form.

c. Students may be exempted from tuition fees (SPP) during their academic leave if the leave application is submitted along with approval from the Rector. However, tuition fees will be charged to students who attempt academic leave without consent from the Rector, or the academic leave approval form is submitted after the deadline of academic leave submission. The same regulation applies to new students.
d. Rector's Decree determines the amount of tuition fee (SPP).

3.4 STUDENT IDENTITY CARD (KTM)

Registered students will be given student identity cards (KTM) in physical plastic cards attached with "barcode number" and RFID which registration is validated with a "hot stamp".

a. The student identity card (KTM) will be given to students who have completed all administrative registration terms.
b. If the student finds incorrect information attached to the identity card (KTM), the student must report it to the Bureau.
c. Academic Administration and Cooperation (BAAK) will replace the old KTM with the new one.
d. KTM is a statement of registration for the student of Universitas Brawijaya during the respective semester

3.5 STUDENT MUTATION

Student mutations are changes in student status, which include academic and administrative status. Student mutation is classified as follows:

3.5.1 Academic Leave

a. Academic leave is a delay of administrative registration for a certain period under the Rector's approval and may be executed from semester III.

b. Students may apply for academic leave for a maximum of 4 (four) semesters for a vocational, undergraduate, and double degree and a maximum of 2 (two) semesters for postgraduate programs, including specialists.
c. The period of academic leave is exempted from the period of study. However, for students who do not re-register without approval from the Chancellor, the academic leave period will deduct their study period.
d. Students may apply for academic leave under the following conditions:
    1. Long-term sickness/illness.
    2. Maternity leave.
    3. Domiciled/work in a place that is impossible to perform the learning process.
    4. Other acceptable conditions
e. Submission of academic leave must be addressed to the Rector with reasonable conditions, noticed by the Dean and student's parents/ guardians/ student agencies. Submission is no longer than 1 (one) week since the closing date of academic registration.

3.5.2 Grantee

Faculty of Agricultural Technology, Universitas Brawijaya accepts grantee from Government/private institutions under the following conditions:

a. Academic Diploma /Baccalaureate / Bachelor Degree / Master Degree at State University.
b. Having completed academic and administrative requirements.
c. The grantee graduated from the relevant Faculty or Study Programs.
d. The Rector accepts the grantee's admission upon the consideration of the Dean/ Head of Postgraduate Program and with possible capacity. The grantees are required to submit a written application to the Rector and cc to the Dean / Head of Postgraduate Program no longer than 1 (one) month before the new academic year starts.

e. The grantees provide the Letter of Recommendation from relevant institutions/Government.

3.5.3 Drop Out

Students will be dropped out if they are unable to perform required study success evaluation terms for each year of study to the end of the study, or when the students are not registered because they do not submit the registration as required by the faculty/ program.

a. The Dean will report the number of students dropping out of college for each semester to the Rector.
b. The Rector issues a Decree concerning the dropped-out students.

3.5.4 Pass away

If a student passes away, the Dean will report to the Rector.

3.5.5 Termination as a student of Universitas Brawijaya

Students may be terminated permanently or temporarily if they violate the Rector's Regulation Number 328 / PER / 2011 concerning the Student Code of Ethics and other provisions applied in Universitas Brawijaya.

IV. CURRICULUM OF EDUCATION PROGRAM IN THE FACULTY OF AGRICULTURAL TECHNOLOGY UNIVERSITAS BRAWIJAYA

4.1. CURRICULUM STRUCTURE OF BACHELOR PROGRAM (S1)

4.1.1. DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY

1). The Bachelor of Food Technology

Code	Course	Credits			Prerequisite
		Class	Lab	Σ	
Semester I					
MPK60007	*Bahasa Indonesia*	2	0	2	
MPK60008	*Pancasila*	2	0	2	
TPF60007	*Personality Development and Professional Ethics*	2	0	2	
TPF61001	*Biology*	2	0	2	
TPF61002	*Laboratory Work of Biology*	0	1	1	
TPF61005	*Physics*	2	0	2	
TPF61006	*Laboratory Work of Physics*	0	1	1	
TPP61001	*General Chemistry*	2	0	2	
TPP61002	*Laboratory Work of General Chemistry I*	0	1	1	
TPP61003	*Calculus*	3	0	3	
TPP61004	*Introduction to Food Science and Technology*	2	0	2	
	Sub Total	**17**	**3**	**20**	
Semester II					
MPK60001-5	*Religion*	2	0	2	
MPK60006	*Civics*	2	0	2	

Code	Course	Credits			Prerequisite
		Class	Lab	Σ	
TPF60010	*Statistics*	3	0	3	
TPF62008	*Organic Chemistry*	2	0	2	
TPF62009	*Laboratory Work of Organic Chemistry*	0	1	1	
TPP62001	*General Chemistry II*	3	0	3	
TPP62002	*General Microbiology*	2	0	2	
TPP62003	*Laboratory Work of General Microbiology*	0	2	2	
TPP62004	*Communication Skills*	2	0	2	
TPP62005	*Food Engineering I*	2	1	3	
	Sub Total	**18**	**4**	**22**	
Semester III					
UBU60004	*English*	2	0	2	
TPF61014	*Scientific Method*	2	0	2	
TPP61005	*Biochemistry*	4	0	4	TPF62008
TPP61006	*Nutrition Physiology and Metabolism*	2	0	2	
TPP61007	*Food Chemistry*	3	0	3	
TPP61008	*Food Physical Chemistry*	2	0	2	
TPP61009	*Food Engineering II*	2	1	3	
TPP61010	*Food Microbiology I*	2	0	2	TPP62002
TPP61011	*Food Material Science*	3	0	3	
	Sub Total	**22**	**1**	**23**	
Semester IV					
TPP62006	*Nutrition Evaluation*	2	0	2	
TPP62007	*Food Microbiology II*	2	0	2	TPP62002, TPP62002
TPP62008	*Food Analysis*	3	0	3	
TPP62009	*Laboratory Work of Food Biochemistry and Analysis*	0	2	2	
TPP62010	*Food Engineering III*	3	0	3	
TPP62011	*Food Processing Technology*	3	0	3	
TPP62012	*Laboratory Work of*	0	2	2	

Code	Course	Credits			Prerequisite
		Class	Lab	Σ	
TPP62013	*Food Processing Technology Sanitation and Waste Treatment*	3	0	3	
TPP62014	*Quality Management System and Halal Assurance*	2	0	2	
TPP62015	*Enzymology*	2	0	2	
	Sub Total	**20**	**4**	**24**	
Semester V					
TPP61012	*Experimental Design*	2	0	2	
TPP61013	*Laboratory Work of Nutrition Evaluation*	0	1	1	
TPP61014	*Laboratory Work of Food Microbiology*	0	2	2	TPP62002, TPP61010, TPP62007
TPP61015	*Sensory Analysis*	2	0	2	TPF60010
TPP61016	*Laboratory Work of Sensory Analysis*	0	1	1	
TPP61017	*Quality Control*	2	0	2	TPF60010, TPP62008, TPP62011, TPP62014
TPP61018	*Food Additives and Ingredients*	3	0	3	TPP61007, TPP62011
TPP61019	*Food Packaging and Storage*	3	0	3	
	Elective Courses	8	0	8	Total credits of 3-4 Elective courses
	Sub Total	**20**	**4**	**24**	
Semester VI					
UBU60003	*Entrepreneurship*	2	0	2	
TPF60015	*Laboratory Work of Entrepreneurship*	0	1	1	

Code	Course	Credits			Prerequisite
		Class	Lab	Σ	
TPP62016	*Product Development*	2	0	2	TPP61012, TPP62014, TPP61017
TPP62017	*Food Regulation*	2	0	2	
TPP62018	*Food Safety and Toxicology*	3	0	3	TPP62002, TPP62007
TPP62019	*Food Processing Unit Design*	3	1	4	
	Elective Courses	10	0	10	Total credits of 4-5 elective courses
	Sub Total	**22**	**2**	**24**	
Odd or Even Semester					
UBU60001	*Internship*	0	3	3	
UBU60002	*Undergraduate Thesis*	0	6	6	
UBU600...	*Community Service*	0	4	4	
	Sub Total	**0**	**13**	**13**	
	Compulsory Courses	**101**	**18**	**119**	
	Minimum Elective Courses	**12**	**0**	**12**	
	Total Credits	**112**	**32**	**144**	
Elective Courses					
Odd Semester					
TPP61020	*Animal Product Processing Technology*	3	0	3	
TPP61021	*Nutraceutical and Functional Foods*	2	0	2	
TPP61022	*Culinary Management*	2	0	2	
TPP61023	*Plantation Crop Product Technology*	2	0	2	
TPP61024	*Polysaccharides and Sugar Technology*	2	0	2	
TPP61025	*Fats and Oils Technology*	2	0	2	

Code	Course	Credits			Prerequisite
		Class	Lab	Σ	
TPP61026	*Snacks and Candy Technology*	2	0	2	
TPP61027	*Molecular Gastronomy*	2	0	2	
TPP61028	*Innovative Food Technology and Engineering*	3	0	3	
TPP61029	*Spices and Essential Oil Technology*	2	0	2	
TPP61030	*Thermobacteriology*	2	0	2	
TPP61031	*Fermented Foods*	3	0	3	
	Sub Total	**27**	**0**	**27**	
Even Semester					
TPP62020	*Post- Harvest Physiology and Technology*	2	0	2	
TPP62021	*Community Nutrition and Public Health*	2	0	2	
TPP62022	*Trends in Food and Nutrition*	2	0	2	
TPP62023	*Food and Nutrition Intervention*	2	0	2	
TPP62024	*Consumer Study*	2	0	2	
TPP62025	*Natural Preservatives*	2	0	2	
TPP62026	*Food Crops Processing Technology*	3	0	3	
TPP62027	*Horticultural Products Technology*	3	0	3	
TPP62028	*Food and Nutritional Bioassay*	2	0	2	
TPI 62061	*Occupational Safety and Industrial Environment*	2	0	2	
	Sub Total	**22**	**0**	**22**	

2) The Bachelor of Biotechnology

a. **General Description**

The Bachelor of Biotechnology Study Program at Universitas Brawijaya is an undergraduate education program that focuses on industrial biotechnology. The program was founded in 2014 with the following vision, mission, and objectives:

b. **Vision**

To become a science and technology development center that produces globally competitive human resources in the field of industrial biotechnology.

c. **Mission**

1. To provide a quality education program in industrial biotechnology that can compete nationally and internationally.
2. To perform research in industrial biotechnology that produces useful products for human welfare.
3. To conduct diffusion of science and technology to the community in the face of the bioeconomic era.

d. **Objectives**

1. To produce quality human resources in industrial biotechnology.
2. To produce quality research in the form of scientific publications and intellectual property rights (IPs) that are beneficial for developing industrial biotechnology at the national and international levels.
3. To take an active role in the diffusion of science and technology related to industrial biotechnology development.

e. **Program Learning Outcomes (PLOs)**

Graduates of the program will:

1. Have the knowledge of and technical skills in industrial biotechnology and the ability to use these competencies to address industrial biotechnology problems in a wide range of industries including (but not limited to) food, feed, pharmaceutical, chemical, material, and energy industries.
2. Have a professional attitude: the ability to communicate effectively, work in teams, and lead under pressure; uphold professionalism ethics; and be responsible.
3. Have the ability to develop oneself into a lifelong learner to face future challenges.

f. Intended Learning Outcomes (ILOs)

The ILOs of the Biotechnology Study Program are structured into four general outcomes (Greek numbering: I–IV). The knowledge and skill proficiencies (described in numbers II and III) are further divided into sub-categories with alphabetic and Arabic numbering. Note that this numbering system will be used in the **course-ILO matrix**.

Students of the program will:

I. Have acquired the foundational knowledge of mathematics and the natural sciences and understand their relevance to industrial biotechnology. This fundamental competency is divided into three domains:
   A. Knowledge of mathematics and statistics.
   B. Knowledge of the natural sciences (biology, chemistry, and physics).
   C. Knowledge of basic biotechnology.

II. Have acquired the theoretical and applied concepts of industrial biomass-to-bioproducts conversion (through physical, chemical, and biological processes) that support the realization of a sustainable green bio-economy. This main competency is divided into three domains:
   A. Knowledge of biomass as a resource or agent for making bioproducts.
      1. Distribution of biomass-based on taxa (virus, archaea, bacteria, protists, fungi, animals, and plants), origin (terrestrial and aquatic), and type (naturally occurring and human-made waste).
      2. The biology of biomass (evolution, the genetic basis of traits, and the molecular/cellular processes that give rise to them), their databases, and cross-taxa interaction.
      3. The biochemistry and chemical composition of biomass (metabolism and its products: carbohydrates, lipids, proteins, nucleic acids, and primary and secondary metabolites).
      4. The physical and chemical properties of biomass and their changes following conversion processes.
      5. Biomass derivatization: types of derivatives (molecule, polymers, cell, and tissue) and their uses.
      6. Valorization of biomass derivatives through biorefinery principles to increase their values.
      7. The life cycle and sustainable management of biomass.
      8. The manipulation of biomass for the food, feed, medical, renewable energy, and environmental sectors.

B. Knowledge of biomass-to-bioproducts conversion processes on a lab, pilot, and an industrial scale.
   1. Physical, chemical, and biological pre-treatment technologies for the deconstruction and decomposition of biomass and the extraction of their components (derivatization).
   2. Bioprocess technology (principles, design, instrumentation, and optimization) for converting biomass components to higher-value bioproducts (valorization).
   3. Conversion of biomass components into bioproducts: principles, enzymes, and reactions.
   4. Separation and purification techniques of bioproducts from other biomass components.
   5. Industrial biotechnology waste treatment technologies.
   6. Recent developments in industrial biotechnology processes.

C. Knowledge of industrial biotechnology products and services as well as bio-entrepreneurship.
   1. Types, variety, and specifications of bioproducts.
   2. Bioproducts quality, safety, and authenticity assurance systems, including halal food and drug system.
   3. The industrial biotechnology market.
   4. Traditional businesses that use biotechnology and trends in the development of industrial biotechnology products and services.
   5. Management and legal aspects of biotechnology businesses.
   6. Small, medium, and large-scale biotechnology enterprise business models and development.

III. Have acquired technical knowledge and demonstrate proficiency in skills that support work in industrial biotechnology.

A. Specific skills in biotechnology.
   1. Basic laboratory techniques in biology, chemistry, and physics.
   2. Molecular techniques, including the isolation of genetic materials, gene expression analyses, protein production and preservation, and biochemical assays.
   3. Cellular techniques including screening, isolation, selection, and identification of microorganisms; cell propagation; cell viability assay; and cell culture preservation.
   4. Biomass-to-bioproducts conversion techniques including physical and chemical pre-treatment; biological digestion; cell

and enzyme immobilization; bioprocess design, instrumentation, and optimization; bioproducts separation and purification.

5. Data acquisition from databases and their annotation and interpretation; research data analyses using software and their presentation.
6. Genetic engineering techniques including plasmid design using biological databases and software, plasmid construction and transformation to host cells, and confirmation of transformants.
7. Strain improvement techniques, including random mutagenesis and DNA recombinant technology.
8. Detection methods for contaminants, product adulteration, foreign genes, and GMOs.

B. Transferable skills.

1. Research skills (critical thinking, problem-solving, project management, scientific communication).
2. Entrepreneurial skills (leadership, teamwork, product development, and business management).
3. Social and interpersonal skills (oral and written communication, respect for others, and responsibility).

IV. Demonstrate the aptitude for lifelong professional and personal development.

g. Course Structure

The curriculum of the Biotechnology Study Program is structured into five main **modules**. Here we define modules as groups of courses that contribute to the attainment of specific learning outcomes. The five main modules are:

1. Basic module: **compulsory** courses for laying the foundational knowledge of mathematics and natural sciences.
2. Core module: **compulsory** courses for building the theoretical and applied concepts of industrial biotechnology.
3. Personality module: **compulsory** courses for instilling nationalism and developing personality.
4. Final Project module: **compulsory** projects for developing research, entrepreneurial, social, and interpersonal skills.
5. Elective module: **optional** courses or projects for enriching knowledge and skills in diverse fields; **may be taken in other institutions**.

The five main modules above constitute approximately 195 ECTS of lectures and 45 ECTS of practical work (depending on the ECTS of the electives taken). The ratio between theory and practice is approximately 4.3:1.

h. Modules

The description and content of the five main modules are given as follows.

Basic Module	
Description	The Basic Module is designed to equip students with the knowledge of mathematics and the natural sciences and prepare them for other courses in other modules in the program.
Course (sks)	Biology (2-1); General Microbiology (2-2); General Chemistry (2-1); Organic Chemistry (2-1); General Physics (2-1); Mathematics (3-0); Statistics (2-1); Introduction to Biotechnology (3-0);
Content	In this module, students learn about biology, microbiology, chemistry, organic chemistry, physics, mathematics, statistics, and their relevance to industrial biotechnology.
Core Module I: Biomass	
Description	Core Module I is designed to equip students with the knowledge of and skills in the biology, chemistry, and physics of biomass. Here, biomass is broadly defined as any organic matter from any taxa (virus, archaea, bacteria, protists, fungi, animals, or plants) and not confined to those originating from living plants as would generally be defined in the field of renewable energy. In this sense, biomass can serve both as a resource (material) and as an agent for making bioproducts from bioconversion processes. This module is divided into four sub-modules: Biomaterials; Biomolecules and Cells; Bioanalyses, and Bioengineering.
Sub Module 1: Biomaterials	
Course (sks)	Biomaterials (2-1)
Content	In **Biomaterials**, students learn about biomass's physical and chemical properties as a material and how these properties change during processing.
Sub Module 2: Biomolecules and Cells	
Course (sks)	Biochemistry (4-0); Enzymology (2-1); Genetics (2-0); Molecular and Cell Biology (3-0)

Content	In **Biochemistry**, students learn about the chemistry of biomolecules from carbohydrates to nucleic acids. In **Enzymology**, students learn about the principles of how enzymes work. In **Genetics**, students learn about the principles of inheritance. In **Molecular and Cell Biology**, students learn about the molecular mechanisms underlying how cells work.
Sub Module 3: Bioanalyses	
Course (sks)	Biochemistry and Enzymology Lab Work (0-1); Analytical Techniques in Biotechnology (2-1)
Content	In **Biochemistry and Enzymology Lab Work**, students learn about the principles of general biomolecule analyses. In **Analytical Techniques in Biotechnology**, students learn about the principles of more advanced techniques and methods used to analyze biomass.
Sub Module 4: Bioengineering	
Course (sks)	Introduction to Bioinformatics (2-0); Genetic Engineering (3-1)
Content	In an **Introduction to Bioinformatics**, students learn about biological data (in databases) and their analyses. In **Genetic Engineering**, students learn about the principles of microbial engineering and how to design constructs for specific purposes.
Core Module II: Bioprocess	
Description	Core Module II is designed to equip students with the knowledge of and skills in bioconversion processes' engineering principles. This module is divided into two sub-modules: Bioprocess Engineering and Bioprocess Technology.
Sub Module 1: Bioprocess Engineering	
Course (sks)	Principles of Bioprocess Engineering (3-0); Bioprocess Unit Operations 1 (2-0); Bioprocess Unit Operations 2 (3-0); Bioprocess Unit Design (3-0)
Content	In **Principles of Bioprocess Engineering**, students learn about the basics of engineering calculations in material and energy balances. In **Bioprocess Unit Operations 1**, students learn about the principles of upstream and downstream operations in bioprocessing plants. In **Bioprocess Unit**

	Operations 2, students learn about the principles of reactions and bioreactor engineering. In **Bioprocess Unit Design**, students learn how to design bioprocessing plants and calculate their feasibility.
Sub Module 2: Bioprocess Technology	
Course (sks)	Introduction to Bioprocess Technology (2-0); Industrial Microbiology and Biotechnology (2-1); Enzyme Technology (3-0)
Content	In an **Introduction to Bioprocess Technology**, students learn about the principles of fermentation technology as well as upstream and downstream processing. In **Industrial Microbiology and Biotechnology**, students learn about the principles of biorefineries for sustainability. In **Enzyme Technology**, students learn about the basics of industrial enzymes, from discovery to applications.
Core Module III: Bioproducts	
Description	Core Module III is designed to equip students with the knowledge and skills in biotechnology products' management and business aspects.
Course (sks)	Product Development and Regulation in Biotechnology (3-0); Quality Control (2-0); Quality Management and Halal Assurance System (2-0); Engineering Economics (3-0)
Content	In **Product Development and Regulation in Biotechnology**, students learn about the principles of bioproduct development and regulation. In **Quality Control**, students learn about the principles of process control for delivering quality products. In **Quality Management and Halal Assurance System**, students learn about the basics of quality assurance systems. In **Engineering Economics**, students learn about the application of economic principles in the analysis of management decisions.
Core Module IV: Final Project-Supporting Courses	
Description	Core Module IV is designed to equip students with the knowledge of and skills in scientific and effective communication techniques and prepare students for their final projects (Internship, Community Service, and Undergraduate Thesis).

Course (sks)	Scientific Methods (2-0); Experimental Design (2-0); Seminars in Biotechnology (2-0)
Content	In **Scientific Methods**, students learn about scientific conduct (and misconduct) and academic writing techniques for writing project proposals and reports. In **Experimental Design**, students learn how to design experiments using qualitative and quantitative approaches. In **Seminars in Biotechnology**, students learn to make scientific tables and figures, effective slides and posters, and to present their work in a short seminar format.
Personality Module	
Description	The Personality Module is designed to equip students with the knowledge and skills for personal and professional character development. This module is divided into two sub-modules: Personal Character and Professional Character.
Sub Module 1: Personal Character	
Course (sks)	Religion (2-0); Civic Education (2-0); Pancasila (2-0); Bahasa Indonesia (2-0); English (2-0)
Content	In **Religion**, students learn to build personal qualities based on religious values. In **Civic Education**, students learn about the theoretical and practical aspects of good citizenship. In **Pancasila**, students learn about the national character based on the values embodied in Pancasila. In **Bahasa Indonesia** and **English**, students learn how to use language for effective interpersonal communication.
Sub Module 2: Professional Character	
Course (sks)	Entrepreneurship (2-1); Personality Development & Professional Ethics (2-0)
Content	In **Entrepreneurship**, students learn to build their entrepreneurial character. In **Personality Development & Professional Ethics**, students learn how to develop their personality for professional work.
Final Project Module	
Description	The Final Project Module is designed to equip students with research, social, and interpersonal skills for professional work.
Course (sks)	Internship (0-4); Community Service (0-4); Undergraduate Thesis (0-6)

Content	In an **Internship**, students learn to work professionally on specific projects under supervision in a real-world setting. In **Community Service**, students learn to provide service to the community under supervision. In **the Undergraduate Thesis**, students learn to conduct research on specific projects under supervision.
Elective Module	
Description	The Elective Module is designed to equip students with the knowledge of and skills in specific fields of choice (must be consulted with and approved by the student's academic advisor). This module can be taken in-house (within the study program, department, faculty, or university) or outside of the university.
Course (sks)	Elective courses or learning activities offered by the program or other institutions (total 31).
Content	The student learning experience will vary depending on the chosen courses or learning activities.

i. Course Structure of Bachelor of Food Technology

The list of the courses and credits offered each semester is given as follows.

Code	Courses	Credits			Requirement/s
		L	P	Σ	
Semester I					
MPK60007	Bahasa Indonesia	2	0	2	
UBU60004	English	2	0	2	
TPF61001	Biology	2	0	2	
TPF61002	Biology Lab Work	0	1	1	
TPF61003	General Chemistry	2	0	2	
TPF61004	General Chemistry Lab Work	0	1	1	
TPF61005	General Physics	2	0	2	
TPF61006	General Physics Lab Work	0	1	1	
TPB61001	Mathematics	3	0	3	
TPB61002	Introduction to Biotechnology	3	0	3	
	Sub Total	16	3	19	
Semester II					
MPK6000x	Religion	2	0	2	
MPK60006	Civic Education	2	0	2	
TPF62008	Organic Chemistry	2	0	2	
TPF62009	Organic Chemistry Lab Work	0	1	1	

Code	Courses	Credits			Requirement/s
		L	P	Σ	
TPF60010	Statistics	2	0	2	
TPP62002	Statistics Lab Work	0	1	1	
TPP62003	General Microbiology	2	0	2	
TPB62001	General Microbiology Lab Work	0	2	2	
TPB62002	Genetics	2	0	2	
TPB62003*	Introduction to Bioprocess Technology	2	0	2	
MPK6000x	Principles of Bioprocess Engineering	3	0	3	
	Sub Total	17	4	21	
Semester III					
TPF61012	Biomaterials	2	0	2	
TPF61013	Biomaterials Lab Work	0	1	1	
TPP61005	Biochemistry	4	0	4	
TPP62015	Enzymology	2	0	2	
TPB61003	Biochemistry and Enzymology Lab Work	0	1	1	
TPB61004	Analytical Techniques in Biotechnology	2	0	2	
TPB61005	Analytical Techniques in Biotechnology Lab Work	0	1	1	
TPB61006	Molecular and Cell Biology	3	0	3	
TPB61007*	Bioprocess Unit Operations 1	2	0	2	TPB62003
TPB61008*	Bioprocess Unit Operations 2	3	0	3	TPB62003
	Sub Total	18	3	21	
Semester IV					
TPB62004	Introduction to Bioinformatics	2	0	2	
TPB62005	Genetic Engineering	3	0	3	
TPB62006	Genetic Engineering Lab Work	0	1	1	
TPB62007	Enzyme Technology	3	0	3	
TPB62008	Industrial Microbiology and Biotechnology	2	0	2	
TPB62009	Industrial Microbiology and Biotechnology Lab Work	0	1	1	
TPB62010	Product Development and Regulation in Biotechnology	3	0	3	
TPP61017	Quality Control	2	0	2	

Code	Courses	Credits			Requirement/s
		L	P	Σ	
TPP62014	Quality Management and Halal Assurance System	2	0	2	
TPF60011	Engineering Economics	3	0	3	
	Sub Total	20	2	22	
Semester V					
TPB61009	Bioprocess Unit Design	3	0	3	TPB61007,8
TPF61014	Scientific Methods	2	0	2	
TPB61010	Experimental Design	2	0	2	
TPB61011	Seminars in Biotechnology	2	0	2	
UBU60003	Entrepreneurship	2	0	2	
TPF60015	Entrepreneurship Lab Work	0	1	1	
TPF60007	Personality Development and Professional Ethics	2	0	2	
MPK60008	Pancasila	2	0	2	
	Electives (choose courses offered by the program or other institutions)	x	x	7	
	Sub Total	x	x	23	
Odd/Even Semester					
	Electives (choose courses offered by the program or other institutions)	x	x	24	
TPF60016	Internship	0	4	4	
UBU6000x	Community Service	0	4	4	
UBU60001	Undergraduate Thesis	0	6	6	
	Sub Total	x	x	38	
	Total	x	x	144	
Electives (Odd Semester)					
	Immobilization Techniques	2	0	**13**	
	Applied Microbiology	3			
	Food Biotechnology	2			
	Nutrigenomics	2			
	Introduction to Immunology	2			
	Sub Total	11			
	Electives (Even Semester)				
	Environmental Biotechnology	3			
	Biosensors	2			
	Nanobiotechnology	2			
	Protein Biotechnology	2			

Code	Courses	Credits			Requirement/s
		L	P	Σ	
	Biopharmaceuticals	2			
	Aroma Technology	2			

4.1.2. DEPARTMENT OF AGRICULTURAL ENGINEERING

1). The Bachelor of Agroindustrial Engineering and Biosystem

a. Intended Learning Outcome :

1. An ability to use engineering principles in designing technology products related to the field of Agroindustrial Engineering and Biosystem science
2. Having an attitude, creative and innovative thinking in working with consistently follow professional ethics
3. An ability to manage and utilize natural resources (agriculture and environment) and the supporting resources (human resources, infrastructure, etc.) in an optimal way and sustainable
4. Having attitudes and professional behavior as well as having strong leadership and the ability in scientific communication effectively
5. An ability to identify, formulating, analyzing and solving problems in the field of agricultural engineering through a systems approach
6. An ability to conduct research, explore, develop and apply science and technology in the field of Agroindustrial Engineering and Biosystem science
7. An ability to develop and manage entrepreneurship oriented to agribusiness and agroindustry

b. Program Learning Outcomes (PLO):

1.Competence and confidence agricultural machinery and system designer
2.An enquiring mind and life-long learning professional
3.Globally aware and dynamic engineer in managing sustainable resources
4.Enterprising innovator involving community engagement

c. Course Structure of The Bachelor of Agroindustrial Engineering and Biosystem

1. Compulsory Courses

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
SEMESTER I						
MPK60001	Education of Religion (Islam)	2	0	0	2	Choose based on the student's
MPK60002	Education of	2	0	0	2	

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
	Religion (Catholic)					belief
MPK60003	Education of Religion (Christian)	2	0	0	2	
MPK60004	Education of Religion (Hindu)	2	0	0	2	
MPK60005	Education of Religion (Buddhist)	2	0	0	2	
MPK60006	Civic Education	2	0	0	2	
UBU60004	English Language	2	0	0	2	
TPE61001	Introduction to Agricultural Technology and Biosystem	2	0	0	2	
TPE61002	Basic Mathematics	2	0	0	2	
TPE61003	Physics	3	0	0	3	
TPF61006	Practical of Basic Physics	0	1	0	1	
TPF61003	Basic Chemistry	2	0	0	2	
TPF61004	Practical of Basic Chemistry	0	1	0	1	
TPF61001	Biology	2	0	0	2	
TPF61002	Practical of Basic Biology	0	1	0	1	
Total		17	3	0	20	
SEMESTER II						
MPK60008	Pancasila	2	0	0	2	
MPK60007	Indonesian Language	2	0	0	2	

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
TPF62008	Organic Chemistry	2	1	0	3	
TPF62008	Practical of Organic Chemistry	0	1	0	1	
TP62004	Calculus 1	2	0	0	2	TPE61002
TPF60010	Statistics	2	0	1	3	
TPE62005	Agricultural Science and Biosystem	2	0	0	2	
TPE62005	Practical of Agricultural Science and Biosystem	0	2	0	2	
TPE62007	Computer Application	1	0	0	1	
TPE62008	Practical of Computer Application	0	1	0	1	
TPE62009	Agricultural Material Science	2	0	0	2	
Total		15	4	1	20	
SEMESTER III						
TPE61010	Thermodynamics	2	0	1	3	TPE61002, TPE61003, TPF61006
TPE61011	Statics and Dynamics	2	0	1	3	
TPE61012	Fluid Mechanics	2	0	0	2	
TPE61013	Practical of Fluid Mechanics	0	1	0	1	
TPE61014	Technical	2	0	0	2	

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
	Drawing					
TPE61015	Practical of Technical Drawing	0	1	0	1	
TPE61016	Environmental Measurement	2	0	0	2	
TPE61017	Practical of Environmental Measurement	0	1	0	1	
TPF60011	Engineering Economics	3	0	0	3	
TPE61018	Calculus 2	2	0	1	3	
Total		15	3	3	21	
SEMESTER IV						
TPE62019	Applied Mathematics	2	0	1	3	TPE62004
TPE62020	Strength of Material	2	1	0	3	TPE61011
TPE62021	Practical of Strength of Material	0	1	0	1	TPE61011
TPE62022	Control System	2	0	0	2	TPE61016 TPE61017
TPE62023	Practical of Control System	0	1	0	1	TPE61016 TPE61017
TPE62024	Engineering Material Science	2	0	0	2	
TPE62025	Heat Transfer	2	0	0	2	TPE61010
TPE62026	Practical of Heat Transfer	0	1	0	1	TPE61010
TPE62027	Power in Agriculture 1	2	0	0	2	TPE61010

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
TPE62028	Practical of Power in Agriculture 1	0	1	0	1	TPE61010
TPE62029	Ergonomic and Occupational Health and Safety	2	0	0	2	
TPE62030	Food Physical Properties	2	0	0	2	
Total		14	4	1	21	
SEMESTER V						
TPE61031	Workshop Engineering	2	0	0	2	
TPE61032	Practical of Workshop Engineering	0	1	0	1	
TPE61033	Business Management	2	0	0	2	
TPE61034	Food Processing Technique & Agricultural Products	2	0	0	2	TPE62025, TPE62026
TPE61035	Practical of Food Processing Technique & Agricultural Products	0	1	0	1	TPE62025, TPE62026
TPE61036	Numeric Method	2	0	0	2	TPE62004
TPE61037	Machine Element Design	2	0	0	2	TPE62020
TPE61038	Agricultural Electricity and Energy	2	0	0	2	
TPE61039	Practical of Agricultural	0	1	0	1	

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
	Electricity and Energy					
TPF61014	Research Method and Seminar	0	1	0	1	
TPE61040	Farm Building	2	0	0	2	
TPE61041	Operational Unit	2	0	0	2	TPE62025, TPE62026
Total		18	3	0	21	
SEMESTER VI						
TPF60007	Personality Development and Professional Ethics	2	0	0	2	
UBU60003	Agro-industrial Entrepreneurshi p	2	0	0	2	
TPF60015	Practical of Agro-industrial Entrepreneurshi p	0	1	0	1	
TPE62042	Design of Agricultural Tools and Machineries	2	0	1	3	TPE61037
TPE62043	Operational Research	2	0	0	2	
TPE62044	Agricultural Cultivation Tools and Machineries	2	0	0	2	TPE62027. TPE62028
TPE62045	Practical of Agricultural	0	1	0	1	TPE62027. TPE62028

Code	Courses	Credits				Prerequisite
		K	Pr	R	Σ	
	Cultivation Tools and Machineries					
TPE62046	Land Surveying and Mapping	2	0	0	2	
TPE62047	Practical of Land Surveying and Mapping	0	1	0	1	
TPE62048	Systems Engineering	2	0	0	2	
TPF60016	Student Community Service	0	0	0	3	Has taken 80 sks
UBU60005	Field Practice	0	0	0	4	
Total		14	3	1	26	
SEMESTER VII						
UBU60001	Thesis/ Final Project	0	0	0	6	
	Elective course 1	2	0	0	2	
	Elective course 2	2	0	1	3	
Total		4	6	1	11	
ODD / EVEN						
	Elective course 1	2	1	0	3	
	Elective course 2	2	1	0	3	
Total		4	2	0	6	
Total Credits					**144**	

2. Elective Courses

Code	COURSES	Credits				
		K	Pr	R	Σ	
ODD SEMESTER						
TPE61049	Post-Harvest Technology	2	0	0	2	

Code	COURSES	Credits				
		K	Pr	R	Σ	
TPE61050	Soil and Water Conservation	2	0	0	2	
TPE61051	Practical of Soil and Water Conservation	0	1	0	1	
TPE61052	Dynamics of Machine and Soil	2	0	0	2	
TPE61053	Practical of Dynamics of Machine and Soil	0	1	0	1	
TPE61054	Cultivation Mechanization of Plantation Crop	2	0	0	2	
TPE61055	Irrigation and Drainage	2	0	0	2	
TPE61056	Practical of Irrigation and Drainage	0	1	0	1	
TP61057	Plant Design	3	0	0	3	
EVEN SEMESTER						
TPE62058	Robotics in Bio-system	2	0	0	2	TPE62022, TPE62023, atau TPO62017 TPO62018
TPE62059	Practical of Robotics in Bio-system	0	1	0	1	TPE62022, TPE62023, atau TPO62017 TPO62018
TPL62017	Experimental Design	2	0	0	2	
TPE62060	Pumps and Compressors	2	0	0	2	
TPE60061	Drying and Cooling Techniques	2	0	0	2	TPE61034, TPE61035
TPE62062	Relationship of Soil, Water and Plant	2	0	0	2	
TPE62063	Modeling and Simulation Technique	2	1	0	3	TPE61036
TPE62064	Power in Agriculture 2	2	0	0	2	TPE62027, TPE62028
TPE62065	Practical of Power in	0	1	0	1	TPE62027,

Code	COURSES	Credits				
		K	Pr	R	Σ	
	Agriculture 2					TPE62028
TPE62066	Bioenergy Engineering	2	0	0	2	

2) The Bachelor of Environmental Engineering

a. Competencies / Independent Professional Profiles

Independent Professional Profile of the Bachelor of Environmental Engineering is to form professionals that capable of:

1. Mastering basic knowledge of engineering and the ability to observe, identify and understand environmental issues and also achieve higher education,
2. Demonstrate high ability in applying environmental engineering knowledge to solve environmental problems within the boundaries of the engineering profession,
3. Mastering and developing professional attitudes (wisdom and personality) that are adaptive to socio-culture and technology dynamics according to current developments in addressing environmental issues.

b. Graduate Learning Outcomes

The learning outcomes of graduates determined in the Environmental Engineering Study Program of UB are as follows:

GLO-1 Able to apply mathematics, science, information technology, and basic engineering to gain a comprehensive understanding of environmental engineering problems

GLO-2 Able to design systems, components, or processes based on mass and energy balance, transportation of substances in the air, water, and land-based on the principle of sustainability.

GLO-3 Able to design and conduct laboratory and, or field experiments, to analyze and interpret data in the field of environmental engineering and management

GLO-4 Able to demonstrate expertise in environmental engineering and management and an entrepreneur based on consideration of risk, uncertainty, sustainability, and environmental impact.

GLO-5 Able to demonstrate good moral attitudes and comply with professional ethics in an institution, organization, and society related to environmental engineering issues.

GLO-6 Able to communicate mastered knowledge orally and in writing

	in national and international relationships.
GLO-7	Able to work in cross-disciplinary and cross-cultural teams
GLO-8	Able to identify, formulate, review literature, analyze, and solve environmental engineering problems.
GLO-9	Able to apply methods, skills, and modern engineering tools required for environmental engineering practice.
GLO-10	Able to understand the need for lifelong learning, including access to knowledge related to relevant current issues.

c. Course Structure

CODE	COURSES	Credits				Description/ Prerequisites
		K	Pr	R	Σ	
SEMESTER I						
UBU60004	English	2	0	0	2	
TPE61004	Mathematics 1	3	0	0	3	
TPF60010	Statistics	2	0	1	3	
TPE61003	Physics	2	0	0	2	
TPF61006	Basic Physics Practicum	0	1	0	1	
TPF61001	Biology	2	0	0	2	
TPF61002	Biology Practicum	0	1	0	1	
TPF61003	Chemistry	2	0	0	2	
TPF61004	Basic Chemistry Practicum	0	1	0	1	
TPL61001*	Fundamentals of Environmental	3	0	0	3	
	Total	**17**	**3**	**1**	**21**	
SEMESTER II						
MPK60007	Indonesian Language	2	0	0	2	
TPE62002*	Mathematics 2	3	0	0	3	TPL61002
TPL62004*	Climatology	2	0	0	2	TPE61003, TPF61006
TPL62005	Climatology Practicum	0	1	0	1	TPE61003, TPF61006
TPL62006*	Fluid Mechanics	2	0	0	2	TPE61003,

CODE	COURSES	Credits				Description/ Prerequisites
		K	Pr	R	Σ	
	1					TPF61006
TPL62007*	Fluid Mechanics Practicum 1	0	1	0	1	TPE61003, TPF61006
TPL62008*	Environmental Chemistry	2	0	0	2	TPF61003, TPF61004
TPL62009*	Environmental Chemistry Practicum	0	1	0	1	TPF61003, TPF61004
TPL62010$^{\alpha}$	Ecology	2	0	0	2	TPL61001
TPL62011$^{\alpha\beta}$	Environmental Laboratory	2	0	0	2	TPF61003, TPF61004
TPL62012$^{\alpha\beta}$	Environmental Laboratory Practicum	0	1	0	1	TPF61003, TPF61004
TPE62007	Computer Applications	1	0	0	1	
TPE62008	Computer Applications Practicum	0	1	0	1	
	Total	**16**	**5**	**0**	**21**	
SEMESTER III						
TPL61013*	Engineering Mathematics 1	2	0	1	3	TPL62003
TPL61014*$^{\alpha}$	Hydrology	2	0	0	2	TPL62004
TPL61015*	Fluid Mechanics 2	2	0	0	2	TPL62006, TPL62007
TPL61016*	Fluid Mechanics Practicum 2	0	1	0	1	TPL62007
TPL61017	Soil Mechanics	2	0	0	2	TPE61003
TPL61018	Environmental Microbiology	2	0	0	2	TPF61001, TPF61002
TPL61019	Environmental Microbiology Practicum	0	1	0	1	TPF61001, TPF61002
TPL61020$^{\alpha}$	Land Surveying	2	0	0	2	

CODE	COURSES	Credits				Description/ Prerequisites
		K	Pr	R	Σ	
TPL61021$^{\alpha}$	Land Surveying Practicum	0	1	0	1	
TPE61014$^{\beta}$	Technical Drawing	2	0	0	2	
TPE61015$^{\beta}$	Technical Drawing Practicum	0	1	0	1	
	Total	**16**	**5**	**0**	**21**	
SEMESTER IV						
TPL62022	Engineering Mathematics 2	2	0	1	3	TPL61013
TPL62023	Experimental Design	2	0	0	2	
TPL62024$^{\beta}$	Structure Mechanics	2	0	0	2	TPE61003, TPF61006
TPL62025$^{\beta}$	Structure Mechanics Practicum	0	1	0	1	TPE61003, TPF61006
TPL62026$^{\beta}$	Wastewater Treatment	2	0	0	2	TPL62008, TPL61018
TPL62027$^{\beta}$	Wastewater Treatment Practicum	0	1	0	1	TPL62009, TPL61019
TPL62028$^{\beta}$	Unit Operation in Environmental Engineering	2	0	0	2	TPL62008, TPL61018
TPL62029$^{\beta}$	Unit Operation in Environmental Engineering Practicum	0	1	0	1	TPL62009, TPL61019
TPL62030$^{\beta}$	Environmental Conservation	2	0	0	2	TPL61014
TPL62031$^{\beta}$	Environmental Conservation Practicum	0	1	0	1	TPL61014
TPL62032$^{\beta}$	Environmental	2	0	0	2	

CODE	COURSES	Credits				Description/ Prerequisites
		K	Pr	R	Σ	
	Assessment					
TPL62033β	Geographic Information System	2	0	0	2	
	Total	**16**	**5**	**1**	**21**	
SEMESTER V						
TPF61014	Scientific Methodology	2	0	0	2	
TPL61034α	Operations Research in Environmental Engineering	2	0	0	2	
TPL61035	Clean Water Supply Engineering	2	0	0	2	TPL62008, TPL62009
TPL61036	Clean Water Supply Engineering Practicum	0	1	0	1	TPL62009
TPL61037α	Drainage and Sewage	2	0	0	2	TPL61015, TPL61016
TPL61038α	Drainage and Sewage Practicum	0	1	0	1	TPL61016
TPL61039	Air Pollution	2	0	0	2	TPL62004, TPL62005
TPL61040	Air Pollution Practicum	0	1	0	1	TPL62005
TPF60011β	Engineering Economics	3	0	0	3	
TPL61041	Occupational Health and Safety	2	0	0	2	
TPL61042α	Environmental Systems Analysis	2	0	0	2	
	Total	**19**	**3**	**0**	**22**	
SEMESTER VI						

CODE	COURSES	Credits				Description/ Prerequisites
		K	Pr	R	Σ	
TPF60007	Personality Development and Professional Ethics	2	0	0	2	
UBU60003	Entrepreneurship	2	0	0	2	
TPF60015	Entrepreneurship Practicum	0	1	0	1	
TPL62043	Environmental Impact Assessment (EIA)	3	0	0	3	Must not be taken in the previous semester.
TPL62044	Solid and Hazardous Waste Treatment	2	0	0	2	
TPL62045	Project Management	2	0	0	2	
TPL62046	Plumbing	2	0	0	2	TPL62006
TPF60016	Internship	0	3	0	3	Has taken 80 sks
UBU60005	Community Service	0	0	0	4	
	Total	**16**	**6**	**1**	**21**	
SEMESTER VII						
MPK60001	Religion Education (Islam)	2	0	0	2	Taking according to the student's religion
MPK60002	Religion Education (Catholic)	2	0	0	2	
MPK60003	Religion Education (Christian)	2	0	0	2	
MPK60004	Religion Education (Hindu)	2	0	0	2	
MPK60005	Religion Education	2	0	0	2	

CODE	COURSES	Credits				Description/ Prerequisites
		K	Pr	R	Σ	
	(Buddha)					
MPK60006	Citizenship Education	2	0	0	2	
TPL60047[α]	Environmental Management (**Capstone Project**)	0	2	0	2	
TPL60048[β]	Wastewater Treatment Plant Design (**Capstone Project**)	0	2	0	2	
	Total	**4**	**4**	**0**	**8**	
SEMESTER VIII						
MPK60008	Pancasila Education	2	0	0	2	
UBU60001	Thesis / Final Project	0	6	0	6	
	Total	**2**	**6**	**0**	**8**	
	Total Number of Credits				**144**	

** Prerequisite courses (courses that must be taken in the previous semester to take certain courses in the following semester)*
*** Prerequisite courses for taking elective courses.*

3) Bioprocess Engineering

a. Program Learning Outcomes (PLO):

1. Graduates acquire professional leadership roles in bioprocess engineering and related fields leading to a successful career.
2. Graduates establish commitment and contribute toward sustainable and bio-based economy development for a better society.
3. Graduates engang in lifelong learning in conducting practical engineer tasks.

b. Intended Learning Outcomes (ILO)

1. Able to acquire a sound knowledge in mathematics and natural science and apply engineering principles to determine and solve contemporary and complex problems related to bioprocessing.
2. Able to formulate and operate biological resources' conversion processes into bio-based value-added materials related to food, feed, fuels, pharmaceutical, nutraceutical, biomaterials, or biochemicals.
3. Able to design biological reactions and reactors, including its materials, instrumentation, control, and modeling.
4. Able to communicate a creative idea and works effectively within the professional community and larger society.
5. Able to demonstrate an ability to work in multidisciplinary and multicultural teams in developing innovative engineering solutions using complex problem-solving skills.
6. Able to conduct practice-based tasks related to bioprocessing in a responsible, safe, voluntary, self-motivated, and ethical manner.
7. Able to appraise bioprocessing and bioproducts manufacturing and valorization using entrepreneurship principles.

c. Course Structure

1. **Compulsory courses**

Code	Subjects	Credits				Description / Prerequisites
		K	Pr	R	Σ	
SEMESTER I						
MPK60001	Religion (Islam)	2	0	0	2	Taking the course according to the religion of the student
MPK60002	Religion (Catholic)	2	0	0	2	
MPK60003	Religion (Christian)	2	0	0	2	
MPK60004	Religion (Hinduism)	2	0	0	2	
MPK60005	Religion (Buddhism)	2	0	0	2	
MPK60006	Civic Education	2	0	0	2	
UBU60004	English	2	0	0	2	
TPF61003	Basic Chemistry	2	0	0	2	
TPF61004	Practical of Basic Chemistry	0	1	0	1	
TPF61001	Biology	2	0	0	2	

Code	Subjects	Credits				Description / Prerequisites
		K	Pr	R	Σ	
TPF61002	Practical of Biology	0	1	0	1	
TPO61001	Introduction to Bioprocess Engineering	2	0	0	2	
TPE61002*$^{\phi}$	Basic Mathematics	2	0	0	2	
TPE61003*	Physics	3	0	0	3	
TPF61006	Practical of Basic Physics	0	1	0	1	
	Total	**17**	**3**	**0**	**20**	
SEMESTER II						
MPK60007	Indonesian Language	2	0	0	2	
MPK60008	Pancasila	2	0	0	2	
TPF62008	Organic Chemistry	2	0	0	2	
TPF62009	Practical of Organic Chemistry	0	1	0	1	
TPO62002	Engineering Mechanics	2	0	1	3	
TPO62003	Food Chemistry	2	0	0	2	
TPO62004*	Essential Microbiology	2	0	0	2	
TPO62005	Practical of Essential Microbiology	0	2	0	2	
TPO62006**	Introduction to Computer Application	2	0	0	2	
TPO62007	Practical of Introduction to Computer Application	0	1	0	1	
TPE60004*$^{\phi}$	Calculus I	2	0	0	2	TPE61002
	Total	**16**	**4**	**1**	**21**	
SEMESTER III						

Code	Subjects	Credits				Description / Prerequisites
		K	Pr	R	Σ	
TPF60011	Engineering Economics	3	0	0	3	
TPF61012	Biomaterial	2	0	0	2	
TPF61013	Practical of Biomaterial	0	1	0	1	
TPO61008**	Transport Phenomena 1	2	0	0	2	TPE61003
TPO61009	Computer-Aided Design (CAD)	2	0	0	2	
TPO61010	Practical of Computer-Aided Design (CAD)	0	1	0	1	
TPO61011*	Automation 1	2	0	0	2	
TPO61012	Practical of Automation 1	0	1	0	1	
TPO61013*	Basic Biochemistry	2	0	0	2	
TPE61010*	Thermodynamics	2	0	1	3	TPE61003, TPF61006
TPE61018*$^{\phi}$	Calculus 2	2	0	1	3	TPE60004
	Total	**17**	**3**	**2**	**22**	
SEMESTER IV						
TPO62014**$^{\phi}$	Applied Mathematic in Bioprocess	2	0	1	3	TPE61018
TPO62015*	Chemical Reaction Engineering	2	0	1	3	
TPO62016	Transport Phenomena 2	2	0	0	2	TPO61008
TPO62017**	Automation 2	2	0	0	2	TPO61011
TPO62018	Practical of Automation 2	0	1	0	1	TPO61012
TPO62019	Operational Management	2	0	0	2	
TPO62020	Practical of Operational	0	1	0	1	

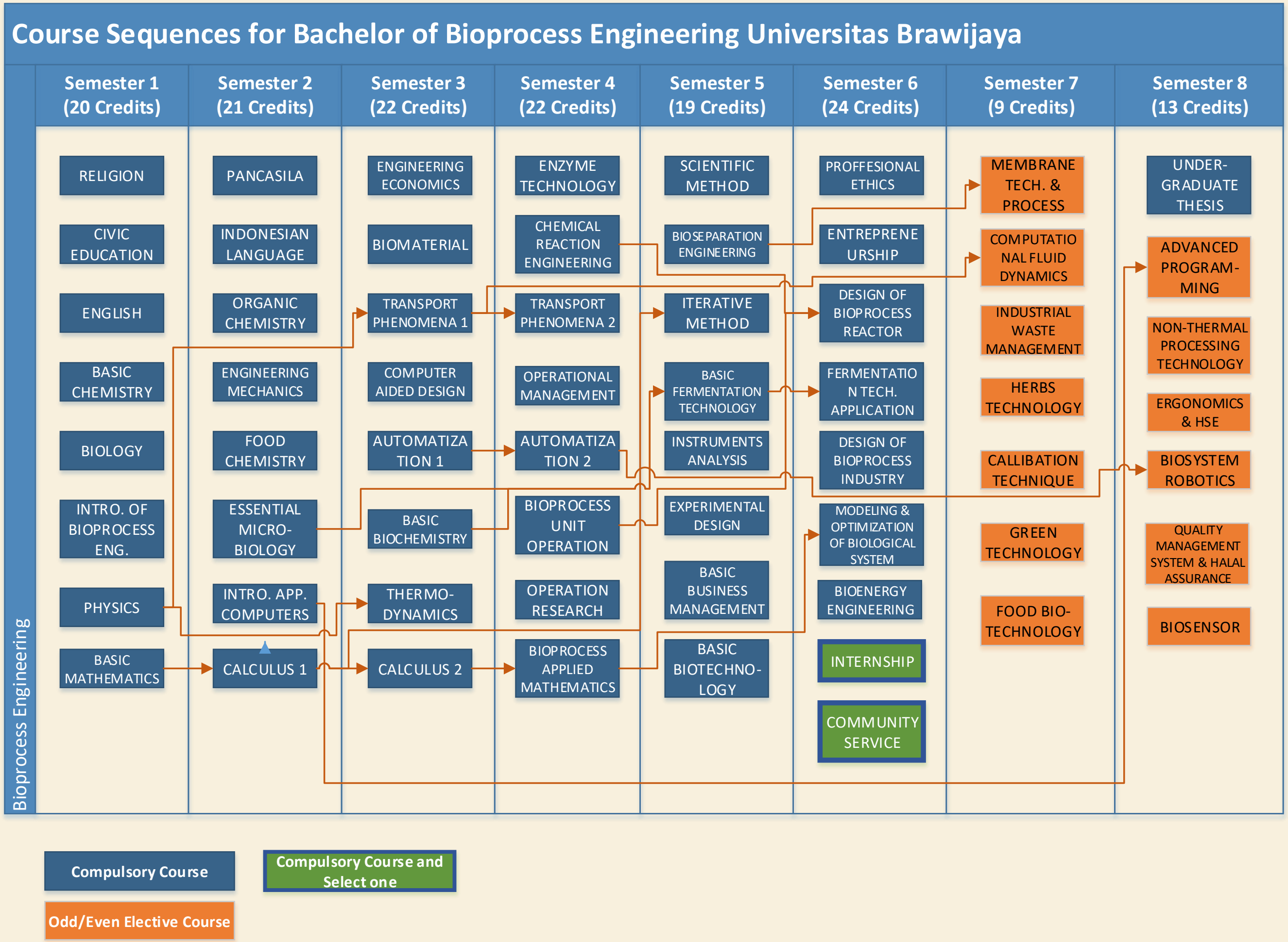
Code	Subjects	Credits				Description / Prerequisites
		K	Pr	R	Σ	
	Management					
TPO62021	Bioprocess Unit Operation	2	0	0	2	
TPO62022	Practical of Bioprocess Unit Operation	0	1	0	1	
TPE62043	Operations Research	2	0	0	2	
TPB62007	Enzyme Technology	3	0	0	3	
	Total	**17**	**3**	**2**	**22**	
SEMESTER V						
TPF61014	Scientific Method	2	0	0	2	
TPO61023**	Bioseparation Engineering	2	0	0	2	
TPO61024	Practical of Bioseparation Engineering	0	1	0	1	
TPO61025$^{\phi}$	Iteration Method	2	0	0	2	TPE60004
TPO61026*	Basic Fermentation Technology	2	0	0	2	TPO62004, TPO61013
TPO61027	Instruments Analysis	3	0	0	3	
TPO61028**	Experimental Design	2	0	0	2	
TPO61029	Practical of Experimental Design	0	1	0	1	
TPO61030	Fundamental of Business Management	2	0	0	2	
TPO61031	Basic of Biotechnology	2	0	0	2	
	Total	**17**	**2**	**0**	**19**	
SEMESTER VI						

Code	Subjects	Credits				Description / Prerequisites
		K	Pr	R	Σ	
TPF60007	Personal Development and Professional Ethics	2	0	0	2	
UBU60003	Entrepreneurship	2	0	0	2	
TPF60015	Practical of Entrepreneurship	0	1	0	1	
TPO62032$^{\alpha}$	Design of Bioprocess Reactor	3	0	0	3	TPO62015, TPO62021
TPO62033$^{\alpha}$	Practical of Bioprocess Reactor Design	0	1	0	1	TPO62015, TPO62021
TPO62034$^{\alpha}$	Industrial Bioprocess Manufacturing	3	0	0	3	
TPO62035	Application of Fermentation Technology	3	0	0	3	TPO61026
TPO62036$^{\phi}$	Modeling and Optimation of Biological Systems	2	0	1	3	TPO62014
TPO62037	Bioenergy Engineering	2	0	0	2	
UBU60002	Internship	0	3	0	3	Has taken 80 SKS
UBU60005	Community Service Program	0	4	0	4	
	Total	**17**	**6**	**1**	**24**	
SEMESTER VII						
	Elective Subject 1	2	1	0	3	
	Elective Subject 2	2	1	0	3	
	Elective Subject 3	2	0	0	2	
	Total	**6**	**2**	**0**	**8**	
SEMESTER VIII						
	Undergraduate Thesis	6	0	0	6	
	Elective Subject 1	2	1	0	3	

Code	Subjects	Credits				Description / Prerequisites
		K	Pr	R	Σ	
	Elective Subject 2	2	0	0	2	
	Elective Subject 3	2	0	0	2	
	Total	**12**	**1**	**0**	**13**	
	Total Credits				**144**	

2. Elective courses

Code	Subjects	SKS				Description / Prerequisites
		K	Pr	R	Σ	
	ODD SEMESTER					
TPO61038	Membrane Technology and Processes	2	0	0	2	TPO61023
TPO61039	Practical of Membrane Technology and Processes	0	1	0	1	TPO61023
TPO61040	Computational Fluid Dynamics	2	0	1	3	TPO61008
TPO61041	Industrial Wastewater Treatment	2	0	0	2	
TPO61042	Herbs Technology	2	0	0	2	
TPO61043	Calibration in Engineering	2	0	0	2	
TPO61044	Practical of Calibration in Engineering	0	1	0	1	
TPL61043	Clean Technology	2	0	0	2	
TPB61014	Food Biotechnology	2	0	0	2	
	EVEN SEMESTER					
TPO62045	Advanced Programming	2	0	0	2	TPO62006
TPO62046	Non-Thermal Processing Technology	2	0	0	2	
TPE62029	Ergonomics, Occupational Health and Safety	2	0	0	2	
TPE62058	Robotics in Biosystems	2	0	0	2	TPO62017, TPO62018
TPE62059	Practical of Robotics in Biosystems	0	1	0	1	TPO62017, TPO62018
TPP62014	Quality Management System and Halal Assurance	2	0	0	2	
TPB62012	Biosensor	2	0	0	2	


Course Sequences for Bachelor of Bioprocess Engineering Universitas Brawijaya
Bioprocess Engineering
Semester 1 (20 Credits)
Semester 2 (21 Credits)
Semester 3 (22 Credits)
Semester 4 (22 Credits)
Semester 5 (19 Credits)
Semester 6 (24 Credits)
Semester 7 (9 Credits)
Semester 8 (13 Credits)
RELIGION
CIVIC EDUCATION
ENGLISH
BASIC CHEMISTRY
BIOLOGY
INTRO. OF BIOPROCESS ENG.
PHYSICS
BASIC MATHEMATICS
PANCASILA
INDONESIAN LANGUAGE
ORGANIC CHEMISTRY
ENGINEERING MECHANICS
FOOD CHEMISTRY
ESSENTIAL MICRO-BIOLOGY
INTRO. APP. COMPUTERS
CALCULUS 1
ENGINEERING ECONOMICS
BIOMATERIAL
TRANSPORT PHENOMENA 1
COMPUTER AIDED DESIGN
AUTOMATIZATION 1
BASIC BIOCHEMISTRY
THERMO-DYNAMICS
CALCULUS 2
ENZYME TECHNOLOGY
CHEMICAL REACTION ENGINEERING
TRANSPORT PHENOMENA 2
OPERATIONAL MANAGEMENT
AUTOMATIZATION 2
BIOPROCESS UNIT OPERATION
OPERATION RESEARCH
BIOPROCESS APPLIED MATHEMATICS
SCIENTIFIC METHOD
BIOSEPARATION ENGINEERING
ITERATIVE METHOD
BASIC FERMENTATION TECHNOLOGY
INSTRUMENTS ANALYSIS
EXPERIMENTAL DESIGN
BASIC BUSINESS MANAGEMENT
BASIC BIOTECHNO-LOGY
PROFFESIONAL ETHICS
ENTREPRENEURSHIP
DESIGN OF BIOPROCESS REACTOR
FERMENTATION TECH. APPLICATION
DESIGN OF BIOPROCESS INDUSTRY
MODELING & OPTIMIZATION OF BIOLOGICAL SYSTEM
BIOENERGY ENGINEERING
INTERNSHIP
COMMUNITY SERVICE
MEMBRANE TECH. & PROCESS
COMPUTATIONAL FLUID DYNAMICS
INDUSTRIAL WASTE MANAGEMENT
HERBS TECHNOLOGY
CALLIBATION TECHNIQUE
GREEN TECHNOLOGY
FOOD BIO-TECHNOLOGY
UNDER-GRADUATE THESIS
ADVANCED PROGRAM-MING
NON-THERMAL PROCESSING TECHNOLOGY
ERGONOMICS & HSE
BIOSYSTEM ROBOTICS
QUALITY MANAGEMENT SYSTEM & HALAL ASSURANCE
BIOSENSOR
Compulsory Course
Compulsory Course and Select one
Odd/Even Elective Course

4.1.3 DEPARTMENT OF AGROINDUSTRIAL ENGINEERING

1) Bachelor of Agroindustrial Engineering

1. Independent Professional Profile (Learning Outcome):

a. Become agroindustrial engineers who are able to apply system engineering, process engineering, management engineering, and information technology in designing, carrying out, and evaluating smart-green agroindustry.
b. Become technopreneurs who are able to manage and develop product innovation and business of local culture-based green agroindustry.
c. Become professionals with the leader character, have a global perspective and passion for learning, and work in a multidisciplinary and/or multicultural team.
d. Become an individual with integrity, fighting spirit, adaptability, communicative and innovative ability, and cognitive flexibility.

2. Program Learning Outcomes (PLO):

a. Able to identify, formulate, analyze, and solve agroindustrial problems by applying mathematics, natural and materials science, and information technology to obtain a comprehensive understanding covering system engineering, process engineering, and engineering management.
b. Able to design system components, system, process, and/or product to fulfill the needs of realistic obstacles by applying methods, skills, and modern engineering tools in the practice of local culture and global perspective-based smart-green agroindustry.
c. Able to design and carry out laboratory and/or field experiments and analyze and interpret the data from an engineering perspective.
d. Able to work in a multidisciplinary and multicultural team, build networks, and to effectively communicate both in writing and verbally.
e. Able to be responsible to society and comply with the ethics and professionalism to identify, solve, and evaluate industrial

engineering problems and become proactive towards current issues.

f. Having awareness of the importance of lifelong learning.
g. Able to apply technopreneurship principles in business of creative-sustainable agroindustry.

3. Course Structure

a. Compulsory Courses

Code	Courses	Credits			Description / Prerequisites
		K	Pr	Σ	
SEMESTER I					
TPF 61005	Physics	2	0	2	
TPF 61006	Physics Lab Work	0	1	1	
TPF 60007	Personality Development and Professional Ethics	2	0	2	
TPI 61001	Organic and Inorganic Chemistry	2	0	2	
TPI 61002	Organic and Inorganic Chemistry Lab Work	0	1	1	
TPI 61003	Biology	2	0	2	
TPI 61004	Biology Lab Work	0	1	1	
TPI 61005	Introduction to Agroindustry	2	0	2	
TPI 61006	Introduction to Economics	2	0	2	
TPI 61007	Mathematics	2	0	2	
TPI 61008	Drawing Techniques	2	0	2	
TPI 61009	Drawing Techniques Lab Work	0	1	1	
Total		**16**	**4**	**20**	
SEMESTER II					
TPF 60011	Engineering Economics	3	0	3	
TPI 62010	Calculus	2	0	2	
TPI 62011	Industrial Microbiology	2	0	2	
TPI 62012	Industrial Microbiology Lab Work	0	1	1	
TPI 62013	Basic of Process Engineering	2	0	2	
TPI 62014	Computer Programming	2	0	2	
TPI 62015	Computer Programming Lab Work	0	1	1	

Code	Courses	Credits			Description / Prerequisites
		K	Pr	Σ	
TPI 62016	Industrial Waste and Environmental Management	2	0	2	
TPI 62017	Human Resources Management	2	0	2	
TPI 62018	Agroindustrial Materials Science	2	0	2	
TPI 62019	Agroindustrial Materials Science Lab Work	0	1	1	
Total		**17**	**3**	**20**	
SEMESTER III					
UBU60004	English	2	0	2	
TPI 61020	Industrial Mathematics	2	0	2	TPI 62010
TPI 61021	Unit Operations	2	0	2	TPI 62013
TPI 61022	Unit Operations lab Work	0	1	1	After/concurrently with TPI 61021
TPI 61023	Industrial Statistics 1	2	0	2	TPI 61007
TPI 61024	Industrial Statistics 1 Lab Work	0	1	1	After/concurrently with TPI 61023
TPI 61025	Product Design and Development	2	0	2	TPI 62019
TPI 61026	Operations Research	3	0	3	TPI 61007
TPI 61027	Work Design and Ergonomics	2	0	2	
TPI 61028	Work Design and Ergonomics Lab Work	0	1	1	After/concurrently with TPI 61027
TPI 61029	Waste Technology	2	0	2	
TPI 61030	Waste Technology Lab Work	0	1	1	After/concurrently with TPI 61029
TPI 61031	Quality Control	2	0	2	TPI 61005
Total		**19**	**4**	**23**	
SEMESTER IV					
MPK 60001	Education of Religion (Islam)	2	0	2	Choose based on the student's belief
MPK 60002	Education of Religion (Catholic)	2	0	2	
MPK 60003	Education of Religion (Christian)	2	0	2	
MPK 60004	Education of Religion (Hindu)	2	0	2	
MPK 60005	Education of Religion (Buddhist)	2	0	2	
MPK 60008	National Resilience Education	2	0	2	

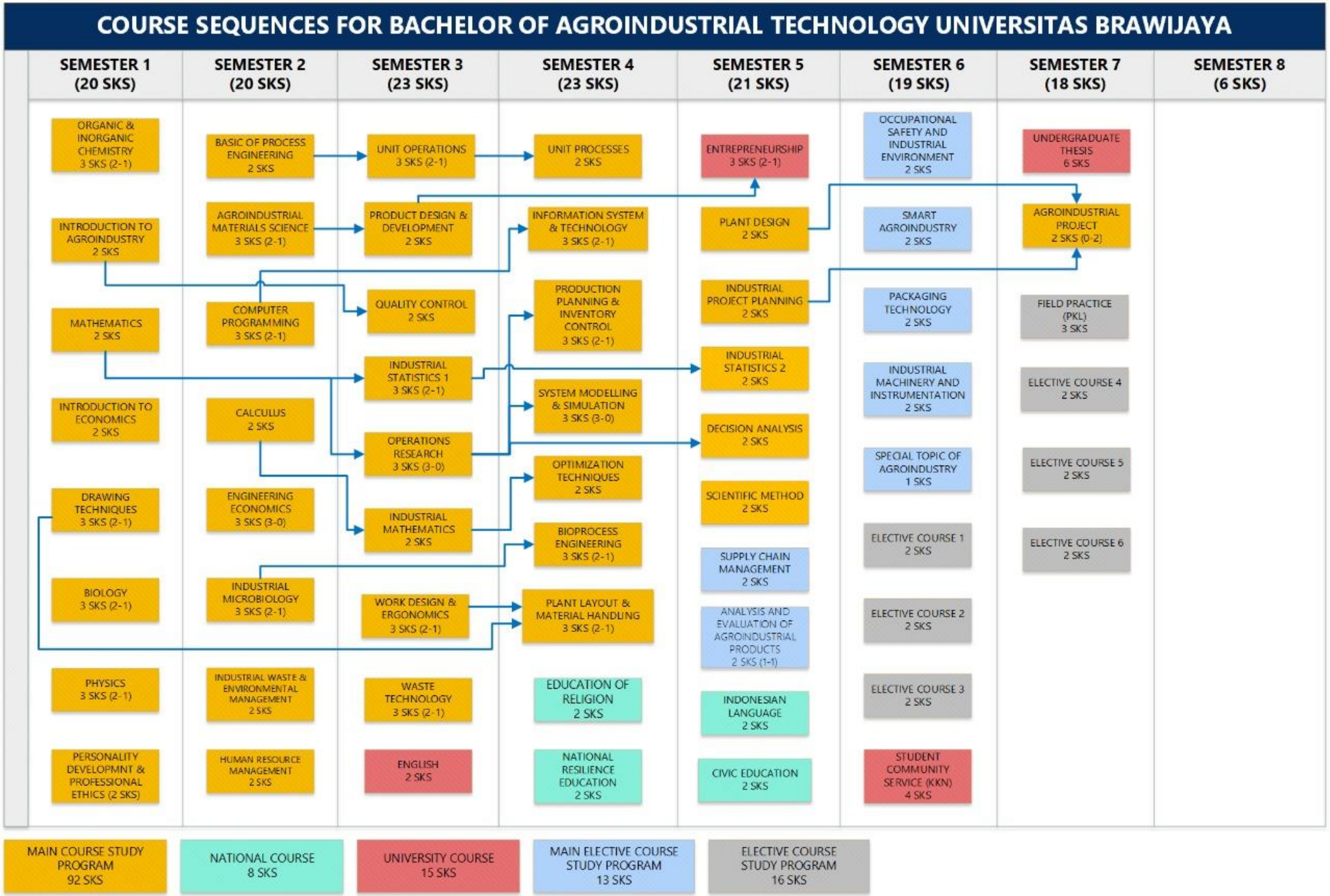
Code	Courses	Credits			Description / Prerequisites
		K	Pr	Σ	
TPI 62032	Unit Processes	2	0	2	TPI 61022
TPI 62033	Optimization Techniques	2	0	2	TPI 61020
TPI 62034	Bioprocess Engineering	2	0	2	TPI 62012
TPI 62035	Bioprocess Engineering Lab Work	0	1	1	After/concurrently with TPI 62034
TPI 62036	Plant Layout and Material Handling	2	0	2	TPI 61009, TPI 61028
TPI 62037	Plant Layout and Material Handling Lab Work	0	1	1	After/concurrently with TPI 62036
TPI 62038	Production Planning and Inventory Control	2	0	2	TPI 61026
TPI 62039	Production Planning and Inventory Control Lab Work	0	1	1	After/concurrently with TPI 62038
TPI 62040	System Modelling and Simulation	3	0	3	TPI 61020; TPI 61026
TPI 62041	Information System and Technology	2	0	2	TPI 62015
TPI 62042	Information System and Technology Lab Work	0	1	1	After/concurrently with TPI 62041
Total		**19**	**4**	**23**	
SEMESTER V					
MPK 60006	Indonesian Language	2	0	2	
MPK 60007	Civic Education	2	0	2	
UBU 60003	Entrepreneurship	2	0	2	TPI 61025
TPF 60015	Entrepreneurship Lab Work	0	1	1	After/concurrently with TPF 60015
TPF 61014	Scientific Method	2	0	2	minimum 72 credits
TPI 61043	Decision Analysis	2	0	2	TPI 61026
TPI 61044	Plant Design	2	0	2	Minimum 5th semester; TPI 62032; TPI 62034
TPI 61045	Industrial Project Planning	2	0	2	Minimum 5th semester; TPI 62017; TPI

Code	Courses	Credits			Description / Prerequisites
		K	Pr	Σ	
					62037; TPI 62039
TPI 61046	Industrial Statistics 2	2	0	2	TPI 61024
	Main Elective Course 1*	2	0	2	
	Main Elective Course 2*	1	1	2	
Total		**19**	**2**	**21**	
SEMESTER VI					
	Main Elective Course 3*	2	0	2	
	Main Elective Course 4*	2	0	2	
	Main Elective Course 5*	2	0	2	
	Main Elective Course 6*	2	0	2	
	Main Elective Course 7*	1	0	1	
	Elective Course 1	2	0	2	
	Elective Course 2	2	0	2	
	Elective Course 3	2	0	2	
	Total	**15**	**0**	**15**	
SEMESTER VII					
TPI 61047	Agroindustrial Project	0	2	2	TPI 61044; TPI 61045
	Elective Course 4	2	0	2	
	Elective Course 5	2	0	2	
	Elective Course 6	2	0	2	
Total		**6**	**2**	**8**	
ODD/EVEN					
UBU 60001	Undergraduate Thesis	0	6	6	TPF 61014; minimum 110 credits
UBU 60002	Field Practice (PKL)	0	4	4	Minimum 80 credits
UBU 60005	Student Community Service (KKN)	0	4	4	
Total		**0**	**14**	**14**	
Total Credits				**144**	

b. Elective Courses

Code	COURSES	Credits			Description / Prerequisites
		K	Pr	Σ	
ODD SEMESTER					
TPI 61048	Supply Chain Management*	2	0	2	TPI 62039
TPI 61049	Analysis and Evaluation of Agroindustrial Products*	1	0	1	TPI 62019
TPI 61050	Analysis and Evaluation of Agroindustrial Products Lab Work*	0	1	1	After/concurrently with TPI 61049
TPI 61051	Risk Management	2	0	2	TPI 62043
TPI 61052	Industrial Psychology	2	0	2	TPI 62017
TPI 61053	Maintenance System	2	0	2	TPI 61024
TPI 61054	Data Mining	2	0	2	TPI 61024
TPI 61055	Process Engineering of Oil, Emulsion, and Oleochemicals	2	0	2	TPI 62032
TPI 61056	Audit of Agroindustry	2	0	2	TPI 61031
TPI 61057	Bioremediation	2	0	2	TPI 61030
TPI 61058	Enzyme and Microbial Technology	2	0	2	TPI 62012
EVEN SEMESTER					
TPI 62059	Industrial Machinery and Instrumentation*	2	0	2	
TPI 62060	Occupational Safety and Industrial Environment*	2	0	2	
TPI 62061	Smart Agroindustry*	2	0	2	
TPI 62062	Special Topic of Agroindustry*	2	0	2	TPI 62015
TPI 62063	Cost Accounting	1	0	1	Minimum 72 credit
TPI 62064	Productivity Analysis	2	0	2	TPF 60011
TPI 62065	Advanced Operation Research	2	0	2	
TPI 62066	Inteligent Systems	2	0	2	TPI 61026
TPI 62067	Process Engineering of Essential Oil and biopharmaceuticals Products	2	0	2	TPI 62042
TPI 62068	Process Engineering of Plantation and Forestry Products	2	0	2	TPI 62032
TPI 62069	Cleaner Production	2	0	2	TPI 62032
TPI 62070	Bioenergy	2	0	2	TPI 62016
TPI 62071	Field Study	2	0	2	TPI 61030
TPI 62072	Industrial Machinery and Instrumentation*	0	1	1	

* Main Elective Course that compulsory to be taken in the internal or external study program


COURSE SEQUENCES FOR BACHELOR OF AGROINDUSTRIAL TECHNOLOGY UNIVERSITAS BRAWIJAYA
SEMESTER 1 (20 SKS)
SEMESTER 2 (20 SKS)
SEMESTER 3 (23 SKS)
SEMESTER 4 (23 SKS)
SEMESTER 5 (21 SKS)
SEMESTER 6 (19 SKS)
SEMESTER 7 (18 SKS)
SEMESTER 8 (6 SKS)
ORGANIC & INORGANIC CHEMISTRY 3 SKS (2-1)
INTRODUCTION TO AGROINDUSTRY 2 SKS
MATHEMATICS 2 SKS
INTRODUCTION TO ECONOMICS 2 SKS
DRAWING TECHNIQUES 3 SKS (2-1)
BIOLOGY 3 SKS (2-1)
PHYSICS 3 SKS (2-1)
PERSONALITY DEVELOPMNT & PROFESSIONAL ETHICS (2 SKS)
BASIC OF PROCESS ENGINEERING 2 SKS
AGROINDUSTRIAL MATERIALS SCIENCE 3 SKS (2-1)
COMPUTER PROGRAMMING 3 SKS (2-1)
CALCULUS 2 SKS
ENGINEERING ECONOMICS 3 SKS (3-0)
INDUSTRIAL MICROBIOLOGY 3 SKS (2-1)
INDUSTRIAL WASTE & ENVIRONMENTAL MANAGEMENT 2 SKS
HUMAN RESOURCE MANAGEMENT 2 SKS
UNIT OPERATIONS 3 SKS (2-1)
PRODUCT DESIGN & DEVELOPMENT 2 SKS
QUALITY CONTROL 2 SKS
INDUSTRIAL STATISTICS 1 3 SKS (2-1)
OPERATIONS RESEARCH 3 SKS (3-0)
INDUSTRIAL MATHEMATICS 2 SKS
WORK DESIGN & ERGONOMICS 3 SKS (2-1)
WASTE TECHNOLOGY 3 SKS (2-1)
ENGLISH 2 SKS
UNIT PROCESSES 2 SKS
INFORMATION SYSTEM & TECHNOLOGY 3 SKS (2-1)
PRODUCTION PLANNING & INVENTORY CONTROL 3 SKS (2-1)
SYSTEM MODELLING & SIMULATION 3 SKS (3-0)
OPTIMIZATION TECHNIQUES 2 SKS
BIOPROCESS ENGINEERING 3 SKS (2-1)
PLANT LAYOUT & MATERIAL HANDLING 3 SKS (2-1)
EDUCATION OF RELIGION 2 SKS
NATIONAL RESILIENCE EDUCATION 2 SKS
ENTREPRENEURSHIP 3 SKS (2-1)
PLANT DESIGN 2 SKS
INDUSTRIAL PROJECT PLANNING 2 SKS
INDUSTRIAL STATISTICS 2 2 SKS
DECISION ANALYSIS 2 SKS
SCIENTIFIC METHOD 2 SKS
SUPPLY CHAIN MANAGEMENT 2 SKS
ANALYSIS AND EVALUATION OF AGROINDUSTRIAL PRODUCTS 2 SKS (1-1)
INDONESIAN LANGUAGE 2 SKS
CIVIC EDUCATION 2 SKS
OCCUPATIONAL SAFETY AND INDUSTRIAL ENVIRONMENT 2 SKS
SMART AGROINDUSTRY 2 SKS
PACKAGING TECHNOLOGY 2 SKS
INDUSTRIAL MACHINERY AND INSTRUMENTATION 2 SKS
SPECIAL TOPIC OF AGROINDUSTRY 1 SKS
ELECTIVE COURSE 1 2 SKS
ELECTIVE COURSE 2 2 SKS
ELECTIVE COURSE 3 2 SKS
STUDENT COMMUNITY SERVICE (KKN) 4 SKS
UNDERGRADUATE THESIS 6 SKS
AGROINDUSTRIAL PROJECT 2 SKS (0-2)
FIELD PRACTICE (PKL) 3 SKS
ELECTIVE COURSE 4 2 SKS
ELECTIVE COURSE 5 2 SKS
ELECTIVE COURSE 6 2 SKS
MAIN COURSE STUDY PROGRAM 92 SKS
NATIONAL COURSE 8 SKS
UNIVERSITY COURSE 15 SKS
MAIN ELECTIVE COURSE STUDY PROGRAM 13 SKS
ELECTIVE COURSE STUDY PROGRAM 16 SKS

4.2. COURSE STRUCTURE OF MASTER PROGRAM

4.2.1. DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY

4.2.1.1 The Master of Agricultural Product Technology

A. Vision, Mision, and Purposes

Vision :

To be an excellent and internationally recognized master study program in the agricultural product technology area to contribute to reliable and competitive agroindustrial development.

Mission :

a. To produce academically qualified human resources which positively contribute to the social community through master education in the agricultural product technology area
b. To develop science and technology related to agricultural product technology area through research activities.
c. To disseminate science and technology related to agricultural product technology area and promote its application for improving agroindustrial community prosperity.

Purposes :

To produce master graduates with competency profile as follows :

a. Able to develop and update the science and technology in the agricultural product technology area.
b. Able to solve the problems in the agricultural product technology area through scientific research and development.
c. Able to develop innovative work for adding values to support agro-industrial development.

B. Learning Outcomes

Attitude

1. Believing in the Almighty God and being able to show religious attitudes

2. Upholding humanity values in performing tasks based on religion, morals, and ethics
3. Engaging as a citizen who is proud and loves the motherland, and having a sense of nationalism as well as being responsible to the nation and the state
4. Contributing to the improvement of quality of life of the people, nation, state, and progress of civilization based on Pancasila (State Philosophy)
5. Cooperating and having social empathy for society and the environment
6. Respecting the diversity of cultures, religions and beliefs, views and opinions or original findings of others
7. Obeying the law and being disciplined in both social and state life
8. Performing responsibility for working in the field of expertise independently
9. Internalizing academic values, norms, and ethics
10. Internalizing and externalizing the spirit of self-reliance and determination
11. Internalizing and externalizing the spirit of entrepreneurship
12. Able to communicate effectively orally and in writing
13. Critical and analytical thinking
14. Has professional and ethical integrity
15. Able to work in diverse teams and overcome conflict problems
16. Being able to lead the team independently
17. Able to work in various conditions and work simultaneously
18. Able to update the knowledge and knowledge possessed and lifelong learning

Knowledge

1. Able to evaluate specific chemical reactions that underlie the nature and reactions of various components of food / agricultural products
2. Able to determine the method of analysis of food components / specific agricultural products

3. Able to develop the concept of food processing technology and agricultural products using the principles of engineering
4. Able to develop the concept of integrated management systems in the food industry and agricultural products
5. Able to explore microorganisms and metabolites that are useful in the fields of food, agricultural products, and the environment
6. Being able to apply in an integrated manner various processing technologies to control the growth of spoilage and pathogenic microorganisms concerning food safety
7. Able to evaluate changes in nutritional and non-nutritional compounds due to processing and storage
8. Able to link the factors that influence the utilization of bioactive components and their effects on health with bio-assay evaluation techniques

General Skill

1. Able to develop knowledge and technology in the field of agricultural product technology through research, to produce innovative and tested work
2. Able to solve problems in the field of agricultural product technology through an inter or multidisciplinary approach
3. Able to manage research and development that is beneficial to society and science, and able to obtain national and international recognition

Specific Skill

1. Able to control chemical reactions that affect the damage and shelf life of food and agricultural products
2. Able to apply the latest processing technology
3. Has product development skills and innovation management
4. Able to apply the principles of shelf life and stabilization of food products
5. Able to conduct and evaluate microbiological quality control systems and food safety

6. Able to develop innovative microorganism-based technologies and products
7. Able to develop intervention and nutrition food products
8. Able to identify and solve problems related to food and agricultural products through the application and incorporation of the principles of food science / agricultural products
9. Being able to apply computer knowledge to solve problems in the science and technology of food / agricultural products
10. Being able to apply the principles of statistics in solving problems of food / agricultural products
11. Able to apply the principles of food science / agricultural products to control and guarantee the quality of a food product

C. Course Structure

a. Compulsory Courses

No	Code	Courses	Credits	Semester
1	TPP81001	Research Methodology and Statistics in Agricultural Product Technology	3	1
2	TPP81002	Advanced Food Analysis	3	1
3	TPP81003	Food Nutrition Evaluation Techniques	2	1
4	TPP81004	Advanced Food Process Engineering	3	1
5	TPP81005	Advanced Food Microbiology	2	1
6	TPP81006	Advance Food Biochemistry	2	1
7	TPP82001	Selected Topic Seminar in the field of Agricultural Product Technology (*)	2	2
Total			**17**	

b. Elective Courses (minimum 12 credit from the following)

Food Chemistry and Biochemistry Laboratory

No	Code	Courses	Credits	Semester
1.	TPP82002	Bioactive of Natural Products	2	2

2.	TPP82003	Advanced Enzyme Technology	2	2
3.	TPP82004	Chemistry of Food Components	2	2
4.	TPP82005	Physiology of Agricultural Products	2	2

Food Processing and Engineering Laboratory

No	Code	Courses	Credits	Semester
1	TPP82006	Advanced Food Processing Engineering	2	2
2	TPP82007	Food Safety Management	2	2
3	TPP82008	Integrated Quality Control	2	2
4	TPP82009	Product Development and Innovation Management	2	2
5	TPP82010	Estimation of Shelf Life and Stability of Food Products	2	2
6	TPP82011	Integrated Sensory Science and Consumer Studies	2	2
7	TPP82012	Waste Management	2	2

Food Microbiology Laboratory

No	Code	Courses	Credits	Semester
1	TPP82013	Advanced Bioprocess Technology (*)	2	2
2	TPP82014	Advanced Food Fermentation	2	2
3	TPP82015	Food Safety Microbiology	2	2
4	TPP82016	Microbiology and Industrial Biotechnology (*)	2	2
5	TPP82017	Environmental Biotechnology	2	2
6	TPP82018	Cell and Molecular Biology (*)	2	2
7	TPP82019	Genetic Engineering (*)	3	2
8	TPP82020	Enzymology (*)	3	2
9	TPP82021	Food Biotechnology (*)	3	2

Note : * = for *double degree*

Food Nutrition Laboratory

No	Code	Courses	Credits	Semester
1	TPP82022	Epidemiology and Nutritional Status	2	2
2	TPP82023	Physiology and Metabolism Substances Advanced Nutrition	2	2
3	TPP82024	Nutrition and Special Diets	2	2
4	TPP82025	Nutrition and Immunology	2	2
5	TPP82026	Nutrigenomics	2	2
6	TPP82027	Development of Functional Food and Supplements	2	2
7	TPP82028	Laboratory work of Nutrition and Bioactive Compounds	3	2

1	TPF80001	Master Thesis	3	12

4.2.2. DEPARTMENT OF AGRICULTURAL ENGINEERING

4.2.2.1. The Master of Agroindustrial Engineering and Biosystem

A. Graduate Profile (Learning Outcome)

1. Able to understand and develop engineering sciences to be applied in the field of agro-complex systems or biosystems.
2. Able to inventory, identify, analyze/evaluate, and design agricultural commodity processes and environmental management of natural resources.
3. Able to carry out environmental assessments and audits as well as to take preventive and control measures against environmental degradation and damage due to agricultural industrialization.
4. Able to follow the development of science and technology related to the future-oriented agricultural and biosystem engineering fields
5. Able to develop knowledge, technology, and/or art in Agroindustrial Engineering and Biosystem or professional practice through research, to produce innovative and tested works.

6. Able to solve problems in science, technology, and/or art in the field of Agroindustrial Engineering and Biosystem through an inter-or-multi-disciplinary approach.
7. Able to manage research and development that is beneficial to society and science and can get national and international recognition.

B. Supporting Competencies

Able to understand and develop the basics of entrepreneurship and standardization, quality management and management of agricultural machinery

C. Other Competencies

1. Able to work in teams and communicate effectively
2. Able to understand professional, ethical, and social responsibilities and be responsive to current issues
3. Have an awareness of the importance of continuous learning (life-long learning)
4. Environmental awareness and awareness of sustainable agro-industrial development.

D. Course Structure

a. Compulsory Courses

Code	Course	Credits	Descriptions/ Terms
ODD SEMESTER			
TPE 81001	Research Methodology	3	
TPE 81002	Agricultural Engineering and Biosystems Management	3	
TPE 81004	Techno Economy	3	
TPE 81005	Advanced Modelling and Optimization Techniques	3	
TPE 81006	Design Techniques	3	
Total		15	

EVEN SEMESTER (For Agro-Biosystem Mechanical Engineering Interest)			
TPE 82019	Agro-Biosystem Machinery Design	3	
TPE 82020	Alternative Renewable Energy	3	
TPE 82021	Bio-product Process Technology	3	
Total		9	
EVEN SEMESTER (For Natural Resources and Environmental Engineering Interest)			
TPE 82001	Engineering Hydrology	3	
TPE 82002	Spatial Technology	3	
TPE 82003	Natural Resources Management Techniques	3	
Total		9	
EVEN SEMESTER (For Agricultural Mechanization Management Interest)			
TPE 82004	Decision-Making Techniques	3	
TPE 82005	Agricultural Mechanization System Analysis	3	
TPE 82006	Agricultural Power and Machinery Management	3	
Total		9	
Total Credits		**24**	

b. Elective Courses

Code	**Course**	**Credits**	**Descriptions/ Terms**
EVEN SEMESTER			
TPE 82007	Physical Properties of Agricultural Products and Materials	2	
TPE 82008	Mechatronics for Agricultural Tools and Machinery	4	
TPE 82009	Energy Conversion Techniques	2	
TPE 82010	Instrumentation and Calibration	2	
TPE 82011	Advanced Environmental Conservation Techniques	2	
TPE 82012	Advanced Water Supply and Irrigation	2	

Code	Course	Credits	Descriptions/ Terms
TPE 82013	Waste Treatment and Management	2	
TPE 82014	Advanced Drainage	2	
TPE 82015	Agricultural Mechanization Project Management	3	
TPE 82016	Sustainable Agricultural Engineering	2	
TPE 82017	Agricultural Engineering Information System	3	
TPE 82018	Agricultural Product Marketing Management	3	

FINAL PROJECT (Thesis)

Code	Course	Credits	Descriptions/ Terms
SEMESTER III/IV			
TPF 80001	Master Thesis	12	

*** Minimal total credit to be taken is: 42 credits**

4.2.3. DEPARTMENT OF AGROINDUSTRIAL ENGINEERING

4.2.3.1 The Master of Agroindustrial Engineering

The Master Program in Agroindustrial Engineering (AT) prepares students with academic abilities to be able to apply and develop aspects of systems engineering, process engineering, and engineering management in the agroindustry field. The curriculum for the Master's Program AT can be completed at least 4 semesters and a maximum of 8 semesters with 40-45 credits consisting of 16 credits of compulsory courses, 12-16 credits of elective courses, and 12 credits of thesis. The Master Program AT is expected to produce graduates according to the level 8 Indonesian National Qualifications Framework (KKNI) with the following competencies:

A. Attitude

1. Believing in the Almighty God and being able to show religious attitudes.

2. Upholding humanity's values in performing tasks based on religion, morals, and ethics.
3. Contributing to the improvement of quality of life of the people, nation, state, and civilization's progress based on Pancasila (State Philosophy).
4. Engaging as a citizen who is proud and loves the motherland, having a sense of nationalism, and being responsible to the nation and the state.
5. Respecting the diversity of cultures, religions and beliefs, views, and opinions, or original findings of others.
6. Cooperating and having social empathy for society and the environment.
7. Obeying the law and being disciplined in both social and state life.
8. Internalizing academic values, norms, and ethics.
9. Performing responsibility for working in the field of expertise independently.
10. Internalizing the spirit of self-reliance, determination, and entrepreneurship.

B. Knowledge Competencies

1. Able to design and develop scientific process engineering, engineering management, and system engineering in the smart and sustainable agro-industrial field.
2. Able to develop research, innovation, standardization, and dissemination of agroindustrial activities to generate a tested and competitive innovative work.
3. Able to solve problems and make decisions and strategic policies through an interdisciplinary or multidisciplinary approach in an environmentally-friendly and sustainable agroindustrial system.
4. Able to develop roadmap-based research with an inter or multidisciplinary approach, both independently and in collaboration with other institutions.
5. Able to develop wider networks with colleagues, users, and the agroindustrial community.

C. Special Skills

1. Able to design, develop, and implement solutions to the agro-industrial problems through systems engineering approaches and engineering management for technopreneurship development in agroindustry.
2. Able to design, develop, and develop the recent process engineering that is efficient, value-added, and competitive in the agroindustry sector.

D. Course Structure

a. Compulsory Courses

Code	Course	Credits
SEMESTER I		
TPI81001	Agroindustry Material Science	2
TPI81002	Research Method and Scientific Writing	2
TPI81003	System Modeling Analysis	2
TPI81004	Agroindustry Production System	2
	Optional Course – 1	2
	Optional Course – 2	2
	Optional Course – 3	2
Sub Total		**14**
SEMESTER II		
TPI82001	Agroindustry Techno-Economy	2
TPI82002	Biotransformation Engineering	2
TPI82003	Agroindustry Supply Chain Strategy and Management	2
	Optional Course – 4	2
	Optional Course – 5	2
	Optional Course – 6	2
Sub Total		**12**
SEMESTER III		
TPI81012	Integrated Agroindustrial development (Lab work)	2
TPF80001	Master Thesis	12
	Total Credits	**40**

b. Elective Courses (minimum 12 credits)

Code	COURSE	Credits
ODD SEMESTER		
TPI81005	Agroindustry Quality System and Management	2
TPI81006	Innovation and Standardization of Agroindustry	2
TPI81007	Human Resource Development	2
TPI81008	Decision Support System	2
TPI81009	Agroindustrial Biotechnology	2
TPI81010	Process Engineering and Secondary Metabolite Product	2
TPI81011	Agroindustry Waste Technology and Management	2
EVEN SEMESTER		
TPI82004	Bioenergy dan Biorefinery	2
TPI82005	Bioremediation	2
TPI82006	Palm Process Engineering	2
TPI82007	Fats and Oleochemical Process Engineering	2
TPI82008	Technology Engineering and Process Design	2
TPI82009	Advanced Optimization Technique	2
TPI82010	Advanced Risk Management	2
TPI82011	Halal Industry	2

Total Minimum 40 credits

4.3. COURSE STRUCTURE OF DOCTORAL PROGRAM

4.3.1. THE DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY

4.3.1.1 The Doctor of Food Science

A. Vision

To become a doctoral study program in food science that produces excellent and innovative human resources in research and developing local resources-based food internationally.

B. Missions

1. To conduct a doctoral education program in food science that produce independent human resources who are able to manage, lead, develop research and participate in the global society
2. To conduct research for developing local resources-based food science that is relevant to solve current problems in supporting national development synergized with other disciplines
3. To disseminate the innovative and applicative research results actively for increasing added value for society

C. Aims

1. To produce independent graduates who are able to develop novelty in food science through the research with inter-, multi-, and trans-disciplines approaches
2. To produce publishable international research in food science
3. To produce innovative and applicative works for society welfare

D. Learning outcomes

1. To be able to develop food science through independent research with inter-, multi-, and trans-disciplines approach.
2. To be able to do recent, innovative, and applicative research in food science giving results and impact to improve local foods' competitiveness.
3. To be able to plan, manage, lead, act and develop a research road map in food science through the inter-, multi- and trans-disciplinary approaches for society welfare
4. To be able to produce novelty, innovative, reliable, and original scientific works to be published in an international journal.

E. The Curriculum of Study Program of Doctor in Food Science

The curriculum of the Study Program of Doctor in Food Science is designed to give students the flexibility to choose courses that supporting their research. Total credit of 42 credits should be taken to finish the doctoral program in 3 years. These credits are 1) 12 credits of courses including 4 credits (2 courses) of mandatory courses and 8 credits (4 courses) of elective courses from 14 courses available, 2) 30 credits for dissertation consist of a) Writing proposal and seminar (3 credits), b) Research and Presentation of research progress (18 credits), c) International publication 2 papers (4 credits), d) Writing dissertation and defense (5 credits).

Study Program of Doctor in Food Science (SPDFS) offers five fields of studies: Chemistry and Biochemistry of Food, Process and Food Engineering, Food Microbiology and Biotechnology and Nutrition, and Sensory and Applied Food Science. Inter- and/or trans- disciplines between food science and other disciplines are also possible.

Student enrollment is opened in the first quarter of the year at around March-April. Students are required to complete some documents, including a short research plan.

F. Course Structure

a. Compulsory Courses

Codes	Courses	Credits	Descriptions/ Terms
Semester I			
TPP91001	Philosophy and Research Method in Food Science	2	
TPP91002	Advanced Food Science	2	
	Supporting dissertation courses	8	
Sub Total		**12**	
Semester II			

Codes	Courses	Credits	Descriptions/ Terms
TPF92001	Qualification examination	1	
TPF92002	Writing proposal and examination	2	
Sub Total		**3**	
Semester III			
TPF91001	Research and presentation of research progress (1st)	6	
Sub Total		**6**	
Semester IV			
TPF92003	Research and presentation of research progress (2nd)	6	
Sub Total		**6**	
Semester V			
TPF91003	Research and Presentation of research progress (3rd	6	
TPF91002	International publication (1st paper)	2	
Sub Total		**8**	
Semester VI			
TPF92004	International publication (2nd paper)	2	
TPF92005	Writing Dissertation and Examination	5	
Sub Total		**11**	
Total		**42**	

b. Elective Courses

No	Code	Courses	Credits
1	TPP91003	Bioactive Compounds and their use	2
2	TPP91004	Interaction of Food Components	2
3	TPP91005	Derivatization of Food Components	2
4	TPP91006	Innovation in Food Processing Technology	2
5	TPP91007	Sensory Science	2
6	TPP91008	Capita Selecta Food Processing Technology	2
7	TPP91009	Production Technology of Bioactive Compounds	2
8	TPP91010	Advanced Food Microbiology	2
9	TPP91011	Food Virology	2
10	TPP91012	Food Biotechnology	2
11	TPP91013	Food Microbial Toxicology	2
12	TPP91014	Molecular Nutrition	2
13	TPP91015	Bioassay Techniques	2
14	TPP91016	Advanced Physiology and Metabolism of Nutrients	2

4.3.2. THE DEPARTMENT OF AGROINDUSTRIAL ENGINEERING

4.3.2.1 The Doctor of Agroindustrial Engineering

Doctoral Program of Agroindustrial Engineering allows the students to choose their courses in supporting their dissertation. This program requires a minimum 42 credits to complete, which are divided into 12 credits for one semester, 30 credits for dissertation consisting of a) 1 credit for qualifying examination; b) 2 credits for proposal examination; c) 18 credits for research and research result seminar; d) 4 credits for the first and second international scientific article publications 1 and 2; e) 5 credits for dissertation writing and dissertation examination. The graduates of this program shall attain level 9 competencies, according to the Indonesian National Qualification Framework (IQF):

A. Attitude

1. Be devoted to God Almighty by showing a religious attitude.
2. Upholding human values in carrying out duties based on religion, morals, and ethics
3. Contributing to improving the quality of life in society, nation, state, and civilization's advancement based on Pancasila.
4. Acting as citizens who are proud and love the country, have nationalism and a sense of responsibility to the state and nation
5. Respect the diversity of cultures, views of life, religions, and beliefs, as well as the original opinions or findings of others
6. Work together and have social sensitivity and care for the community and the environment
7. Obeying the law and discipline in social and state life
8. Internalizing academic values, norms, and ethics
9. Demonstrate an attitude of responsibility for work in their field of expertise independently
10. Internalizing the spirit of independence, struggle, and entrepreneurship

B. Knowledge

1. Mastering the concepts and theories of Agricultural Industrial Technology, which concern the scientific fields of process technology, agro-industrial management, systems engineering, and other related fields.
2. Able to independently integrate Agro-industrial Technology concepts and theories with inter-disciplinary, multidisciplinary, or transdisciplinary approaches in various professions.

C. General Skills

1. Mastering the philosophy and theory of agro-industrial technology science with the field of process technology studies, including

production process optimization techniques, performance analysis of tools and machines, and development of new competitive products.

2. Mastering the philosophy and theory of agro-industrial technology science with the field of process technology studies, including production process optimization techniques, performance analysis of tools and machines, and development of new competitive products.
3. Mastering the philosophy and theory of agro-industrial technology science with the field of systems engineering studies, including supply chain analysis and agro-industrial system integration
4. Mastering the philosophy and theory of Agroindustrial Engineering and Biosystem science with other fields, including Agricultural Cultivation Mechanical Engineering, Soil and Water Engineering, Agricultural Mechanization Systems and Management, Food and Agricultural Products Processing Techniques, Agricultural Energy and Electrification, Agricultural Environment and Buildings, and Agricultural Ergonomics and Electronics.
5. Able to plan and develop sustainable agro-industrial downstream
6. Able to make innovations and their applications in the agro-industrial system.
7. Able to plan and evaluate the agroindustry quality system comprehensively.
8. Able to analyze problems and develop agroindustry policy strategies from upstream to downstream aspects.
9. Able to design and develop innovative agricultural tools and machines integrated into food processing and agricultural products.
10. Able to analyze and explore the application of waste treatment technology to achieve environmentally sound agroindustry business.
11. Able to design and develop a smart farming system based on information technology and control systems.

12. Able to explore renewable energy to support the achievement of environmentally friendly agroindustries.

D. Specific Skills

1. Able to produce novelty, innovative, tested, and original scientific works in agro-industrial technology, especially in technology, management, and agro-industrial systems engineering, can be published on a national and/or international scale.
2. Able to produce novelty, innovative, tested, and original scientific work in the field of Agroindustrial Engineering and Biosystem, especially in fields including Agricultural Cultivation Mechanical Engineering, Soil and Water Engineering, Agricultural Mechanization Systems and Management, Food Processing and Agricultural Products Engineering, Energy and Electrification of Agriculture, Environment and Agricultural Buildings as well as Agricultural Ergonomics and Electronics through independent research activities with inter, intra, multi or transdisciplinary approaches, and can be published on a national and/or international scale
3. Able to solve problems and make strategic decisions and policies within the scope of the agro-industrial system to provide results and have an impact on improving performance, sustainability, and competitiveness of agroindustry
4. Able to plan, manage, lead, implement, and develop a research road map in the field of agricultural industrial technology that is beneficial to stakeholders of the agro-industrial system.

E. Course Structure

No	Codes	Course	Credit	Status	Semester
	COMPULSORY COURSES				
1	TPI91001	Philosophy of Science	2	W	1
2	TPI91002	Agroindustrial Development	2	W	1
3	TPI91003	Agroindustrial Innovation System	2	W	1

	COURSES SUPPORTING DISSERTATION				
3	TPI91004	Integrated Quality System	2	P	1
4	TPI91005	Agroindustry Downstream Biotechnology	2	P	1
5	TPI91006	Agroindustrial Policy Strategy	2	P	1
6	TPI91007	Downstream Product Technology	2	P	1
7	TPI91008	Agriculture Tools and Machinery Engineering	3	P	1
8	TPI91009	Industrial Waste Processing	3	P	1
9	TPI91010	Control and Biosystem Instrumentation	3	P	1
10	TPI91011	Renewable Energy for Industry	3	P	1
	DISSERTATION COURSE				
11	TPF92001	Qualification Examination	1	W	2
12	TPF92002	Proposal Writing and Proposal Examination	2	W	2
13	TPF91001	Research and Research Result Seminar I	6	W	3
14	TPF92003	Research and Research Result Seminar II	6	W	4
15	TPF91002	International Scientific Research Publication I	2	W	5
16	TPF91003	Research and Research Result Seminar III	6	W	5
17	TPF92004	International Scientific Research Publication II	2	W	6
18	TPF92005	Dissertation Writing and Final Examination	5	W	6
Total Credit That Must Be Completed: 42 Credits					

V. COURSE SYLLABUS

5.1. COURSE SYLLABUS OF UNDERGRADUATE PROGRAM

5.1.1 DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY

1) The Bachelor of Food Technology

a. Course with National Content

	COURSES	(Class-Lab)
MPK60001	**RELIGION: ISLAM**	**2 CREDITS (2-0)**
AL QUR'AN and SCIENCE. The creation of life, human, earth and the universe. MAN AND religion. Status and function as human, The purpose and program of human life. The roles of religion in human life. Review of religion, Islam and the other religion. AQIDAH ISLAMIYYAH. Islamic way of life. Definition and urge of tauhid, discussion about Arkanul iman, The benevit of believing. SYARI'AH ISLAMIYYAH. Definition of syari'ah Islamiyyah, source of syari'ah Islamiyyah, Discussion about Arkanul Islam, mu'amalah. AKHLAQ AL ISLAM. Definition about akhlaq, akhlaqul karimah and akhlaqul madsumumah. KAPITA SELEKTA. History of Islam		

MPK60002	**RELIGION: CATHOLIC**	**2 CREDITS (2-0)**
Understanding the concept of belief in the church, live according to the church guideline and live in harmony with the community to develop attitude, personal mentality as a graduate Catholic who serve and act in the interest of the society as a fulfillment of one belief.		

MPK60003	**RELIGION: CHRISTIAN PROTESTANT**	**2 CREDITS (2-0)**
Develop the application of fundamentals of Christian belief to equip		

students with values in order to become a better person as a whole and a new creature in believing Yesus Kristus. Increase the responsibility to Allah through sensitivity towards humanity and the environment of their life. As a student can contribute to the community and to serve based on one duty to serve God

MPK60004	RELIGION: HINDU	2 CREDITS (2-0)
History of Hindu in Indonesia, Three fundamental principles of Hindu , tatwa (phylosophy), susila (ethic), yadya (ritual). Description about Wada, basic of belief in Hindu, panca srada, basic and goals of human life, dharma sidharta, catur marga yoga, panca maha yadya, catur asram, catur warna.		

MPK60005	RELIGION: BUDHA	2 CREDITS (2-0)
The beginning of Budha, epistemology, causality, characteristic of life, karm, reborn, morality and ethics, nirwana, division and characteristics of different religious groups in Budhism, metaphysics, believing in God in Budha, the position of Budha in the civilization, relevance of Budha in the modern era and Indonesia		

MPK60006	CITIZENSHIP	2 CREDITS (2-0)
Citizenship is aimed to develop knowledge and understanding also awareness of National Defense and security (HANKAMNAS) within the students environment in order to create awareness of National Defense (TANAS), besides to build up national discipline, introduction to nationality patriotism, unity in diversity, national defense, political strategy on national defense and national security as a basic to understand community defense and security system.		

MPK60007	BAHASA INDONESIA	2 CREDITS (2-0)

Structure of the sentence in Bahasa Indonesia, syntaxes, pronunciations in Bahasa, logical language, systematic scientific writing, standard terms, foreign language terms acculturation into Bahasa, and local language terms acculturation into Bahasa, the method of making summary.

MPK60008	PANCASILA	2 CREDITS (2-0)
The course is intended to give students the ability to understand the way of life of the nation Pancasila and its implementation in citizens' daily lives. The goals of the course are given at the beginning of the course, national identity, the history of the nation, UUD 1945, the dynamic of the implementation of UUD 1945, Pancasila as a philosophy and political ethics, ideology of the nation, and in the historical context of the nation, Pancasila as the paradigm of one life, one social life and as a citizen, national defense and Wawasan Nusantara (unity in diversity), constitution and democracy, national security, political strategy in national and autonomy of regional area.		

b. University Courses

UBU60001	INTERNSHIP	3 CREDITS (0-3)
Internship in the industries, government or private institution, under the supervision of a lecturer in the certain period. *Requirement: already completing 80 credits*		

UBU60002	UNDERGRADUATE THESIS	6 CREDITS (0-6)
Undergraduate thesis is a scientific report written by the final year students based on the works in the laboratory (experimental laboratory of a research project within or outside the university) or else (surveys, developing business, food industrial internships for a minimum of 3 months and design of applied technology). Undergraduate thesis is executed under the supervision of a lecturer in expertise related to the topic of interest. *Requirement: already completing 110 credits (when writing a thesis proposal)*		

UBU60003	ENTREPRENEURSHIP	2 CREDITS (2-0)
This course discusses the characteristics of a successful entrepreneur (success vision, developing and motivating oneself, solving problem, and running a business), the intrapersonal skill (communication, leadership, and entrepreneurship motivation), creativity development, and innovation in the creation of ultimate quality product or service, marketing (personal and corporate), entrepreneurship management (financial, evaluation and business development)		

UBU60004	ENGLISH	2 CREDITS (2-0)
Skill in English communication both oral and written, active (speaking and writing) and passive (listening and reading). The techniques to communicate technical information to the general audiences, writing scientific report, letters and memo, making formal and informal presentation.		

UBU6000...	COMMUNITY SERVICE	4 CREDITS (0-4)
Community service activity in certain areas is organized in a group, integrated between departments, and coordinated by the faculty. Priority is given to non-physical activity in the field of agriculture to help the community increase their knowledge and skill and therefore, can increase their welfare. The community service activities are divided into 4 steps: briefing, activity on location, report of the activity and results of the intended goals, evaluation of the program. *Requirement: already completing 80 credits*		

c. Faculty Courses

TPF60007	PERSONALITY DEVELOPMENT AND PROFESSIONAL ETHICS	2 CREDITS (2-0)
This course discusses the definition of ethics and moral, ethical code and professionalism, implementation of profession ethical codes in a given institution (ethical codes as a student, lecturer, education and class). The material related to intelligence, personality, communication and empathy related to professional ethics. The course also discusses profession standardization and profession organization/association (national and international levels).		

TPF61001	BIOLOGY	2 CREDITS (2-0)
This course discusses the organic materials that compose cell structure, cell structure and function, cell bioenergetics, cell division and development, gen structure and function, structure, function and benefits of animal, plant and microorganism, Element cycle, Ecology (biotic and abiotic) and biotechnology.		

TPF61002	LABORATORY WORK OF BIOLOGY	1 CREDIT (0-1)
This course discusses the use of the microscope and the procedure to do a calibration of micrometer, microorganism cell structure, cell structure of plant tissues and animal tissues, respiration and photosynthesis, biodiversity of aquatic ecosystem, interaction of biotic components in an ecosystem		

TPF61005	PHYSICS	2 CREDITS (2-0)
The course covers the basic concepts and principles of physics. Topics include dimensions and units, scalar and vector quantities, mechanics, work and energy, fluids, thermodynamics, waves, electromagnetism, optics, relativity, and modern physics.		

TPF61006	LABORATORY WORK OF PHYSICS	1 CREDIT (0-1)

The lab works will be related to the content of Physics course and cover the practical aspects of basica principal of selected topics in the Physics course. Basic principal in determination of physical measurements, static concept and vector force quantification, application of Archimedes Law, introduction to thermal expansion coefficients of different materials, practical aspects of electronic series and application of Ohm and Kirchoff Law.

TPF62008	**ORGANIC CHEMISTRY**	**2 CREDITS (2-0)**
Organic Chemistry course explores the concept of chemical bonding, structure, properties, reactions in organic molecules, isometry and stereoisomers, and classification of compound based on functional groups (alkanes, alkenes, alkynes, aromatic compounds, alkyl halides, alcohols, ethers, aldehydes, and ketones, carboxylic acids and their derivatives, phenols, amines, fats, amino acids, carbohydrates), biomolecule compound and other natural organic compounds.		

TPF62009	**LABORATORY WORK OF ORGANIC CHEMISTRY**	**1 CREDIT (0-1)**
The labworks will cover: identification of alcohol group compounds, aldehide and keton group, qualitative carbohydrate determination, qualitative protein determination, saponification reaction in fat. After completing the labworks, studens are expected to be able to understand and to master the skill of identification of functional group of a given organic compound and doing a qualitative analysis of organic compounds.		

TPF60010	**STATISTICS**	**3 CREDITS (2-1)**
This course discusses basic statistics used in the experimental design of structured research and not-structured research (descriptive research), including the skill to operate computer program and related statistic software.		

TPF61014	**SCIENTIFIC METHOD**	**2 CREDITS (2-0)**
This course discuss scientific writing include: writing of abstract,		

introduction and problem identification, writing a research hypothesis, literature review, designing research method (include determining research variables), writing result and discussion, writing references.   *By the end of the course, students are assigned to write a research report and research article in a scientific journal. Students are given essential oral presentation skills in the making of presentation media and delivering effective oral presentation.*

TPF60015	**LABORATORY WORK OF ENTREPRENEURSHIP**	**1 CREDIT (0-1)**
This lab-course include: making a business plan, presentation of a business plan, product presentation, presentation of marketing concept, discussion with an entrepreneur, implementation of business plan, product marketing, financial report and evaluation, business activity evaluation.		

d. Food Technology Compulsory Courses

TPP61001	**GENERAL CHEMISTRY 1**	**2 CREDITS (2-0)**
General Chemistry I is designed to introduce the fundamental principles in analytical chemistry on distinct chemical reactions. The fundamental principles covered chemistry labs introduction and safety, fundamental laws, electrons and nucleus, periodic tables, chemical bonds, intermolecular bonds and solubility, unit conversions in chemistry, and stoichiometry. The chemistry reactions studied solution and colloids, acid-base reaction, buffer solution, redox reaction, precipitation reaction, and also basic of spectrophotometry analysis. 1 credit of practical work in the laboratory was done to emphasize their quantitative skills.		

TPP61002	**LABORATORY WORK OF GENERAL CHEMISTRY 1**	**1 CREDIT (0-1)**
This lab works, students learn the basic principal on laboratory works, laboratory equipment and work health and safety culture, making solution with given concentrations, principal of acidic-alkalimetry, buffer solution, reduction andoxidation reaction, determination of concentration of substances by using spectrophotometry.		

TPP61003	CALCULUS	3 CREDITS (3-0)
A study of basic principles of calculus. Topics include limits, derivatives, differentiation, linear approximation, curve sketching, optimization, the chain rule for polynomials, integrals, trigonometric functions, and exponential functions.		

TPP61004	INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY	2 CREDITS (2-0)
This course discuss the roles of Food Science and Technology and introductory to chemical-biochemical aspects, engineering and processing of foods, food microbiology and biotechnology and nutrition. The roles of food technology in national food security and sovereignity, the roles of food technology in local food products development, and food safety		

TPP62001	GENERAL CHEMISTRY 2	3 CREDITS (3-0)
General Chemistry II comprises basic knowledge in energy-based chemical transitions and reaction equilibrium. The topics covered thermochemistry, electrochemistry, state of matter and phase diagrams, ideal gas laws and problems, partial pressures and vapor pressure, law of multiple proportions, equilibrium equations, solubility equilibrium, and chemical kinetics. This course also contained principles in chemistry analysis include gravimetry, volumetry, instrumental, and nuclear analysis.		

TPP62002	GENERAL MICROBIOLOGY	2 CREDITS (2-0)
History of microbiology, basic principles of microorganisms, prokaryotes and eukaryotes, viruses. Classification and morphology of bacteria, molds and yeasts, microbial cell structure and function, metabolism, microbial genetics, microorganism metabolism and factors that influence microbial growth. Principles qualitative and quantitative microbiological analysis, conventional microbes' identification (morphology and biochemistry).		

TPP62003	LABORATORY WORK OF GENERAL MICROBIOLOGY	2 CREDITS (0-2)
Laboratory work is designed to provide basic skill of practise in microbiology laboratories. Aseptic methods, methods of sterilization, media and manufacturing methods, enumeration and isolation techniques, Gram staining cultivation and preservation of culture.		

TPP62004	COMMUNICATION SKILL	2 CREDITS (2-0)
Basic knowledge of communication, definition and characteristics of interpersonal, interpersonal communication process, human perception, verbal messages, non-verbal messages, effective communication, the aspects of value, norm and ethic in communication, critical thinking, case discussion applying critical thinking skills, audience-centered analysis and its application		

TPP62005	FOOD ENGINEERING 1	3 CREDITS (2-1)
This course covers an introduction to food engineering principles, including the basic concept of mass and energy balance, gases and vapors, mass transfer, psychrometry, and dehydration.		

TPP61005	BIOCHEMISTRY	4 CREDITS (4-0)
The course is designed to learn about overview of bio-organics on food macro components such as: carbohydrate, protein, fat/oils, vitamin, enzymes, nucleic acid and bioenergetics. The subjects also discuss biosynthesis and metabolism of main component of bioorganic materials, such as: carbohydrate, protein and fats/oils. Signal transduction, transport across membranes, DNA replication and repair, transcription and translation, molecular motors, , and the biosynthesis of natural products		

TPP61006	NUTRITION PHYSIOLOGY AND METABOLISM	2 CREDITS (2-0)
This course discusses basic physiology related to digestion of food macronutrients, mechanism of nutrients absorption, transport of nutrients		

through circulation, and nutrients uptake by cells and their metabolism. The course also discusses the function of macro and micronutrients, nutrient-nutrient interaction, the regulation of nutrients utilization in the human body in different physiological conditions, and the coordinative works to achieve homeostasis.

TPP61007	FOOD CHEMISTRY	3 CREDITS (3-0)
This course discusses the chemical structure, classification, physicochemical properties, chemical reactions, functions of food components, including water, carbohydrate, protein, lipids, pigments, vitamins, minerals, flavors, and other components. The changes, stability, roles, functions, and reactions of food components during food processing and storage are also covered. This course also discusses chemical reactions that limit food shelf life and the chemistry underlying the properties and reactions of food components. The methods for controlling the reactions of food components are also covered.		

TPP62005	FOOD ENGINEERING 1	3 CREDITS (2-1)
This course introduces food engineering principles, including the basic concept of mass and energy balance, gases and vapors, mass transfer, psychrometry, and dehydration.		

TPP61005	BIOCHEMISTRY	4 CREDITS (4-0)
The course is designed to learn about bio-organics overview on macro food components such as carbohydrate, protein, fat/oils, vitamins, enzymes, nucleic acid, and bioenergetics. The subjects also discuss bioorganic materials' biosynthesis and metabolism's main components: carbohydrate, protein, and fats/oils. Signal transduction, transport across membranes, DNA replication and repair, transcription and translation, molecular motors, and the biosynthesis of natural products		

TPP61006	NUTRITION PHYSIOLOGY AND METABOLISM	2 CREDITS (2-0)
This course discusses basic physiology about the digestion of food macronutrients, the mechanism of nutrients absorption, transport of		

nutrients through circulation, and nutrients uptake by cells and their metabolism. The course also discusses the function of macro and micronutrients, nutrient-nutrient interaction, the regulation of nutrients utilization in the human body in different physiological conditions, and the coordinative works to achieve homeostasis.

TPP61007	**FOOD CHEMISTRY**	**3 CREDITS (3-0)**
This course discusses the chemical structure, classification, physico-chemical properties, chemical reactions, functions of food components, including water, carbohydrate, protein, lipids, pigments, vitamins, minerals, flavors, and other components. The changes, stability, roles, functions, and reactions of food components during food processing and storage are also covered. This course also discusses chemical reactions that limit the food shelf life and the chemistry underlying the properties and reactions of food components. The methods for controlling the responses of food components are also covered.		

TPP61008	**FOOD PHYSICAL CHEMISTRY**	**2 CREDITS (2-0)**
This course discusses the fundamental physicochemical properties of foods, including particle size, types of substances (gas, liquid, solid), solutions and their properties (electrolyte and nonelectrolyte), colloidal, suspension, emulsion, foam, and dispersion systems. Basic principles that govern foods' physicochemical properties are also covered, including adsorption, absorption, surface tension, osmosis, diffusion, aggregation, sedimentation, nucleation, and crystallization. The basic principle of food rheology of foods is also discussed in this course.		

TPP61009	**FOOD ENGINEERING 2**	**3 CREDITS (2-1)**
This course is about a study of basic principles of heat transfer and flow of fluids related to food technology and applying food engineering principles in mixing, size reduction, and crystallization.		

TPP61010	**FOOD MICROBIOLOGY 1**	**2 CREDITS (2-0)**
This course covers the characteristic of microbial growth, intrinsic and		

extrinsic factors and their relationship to microbial growth; spoilage microorganisms in foods and the conditions under which they grow, the role and significance of microbial inactivation, adaptation, and environmental factors (i.e., Aw, pH, temperature) on growth and response of microorganisms in various environment. The role of beneficial microbes, food preservation via fermentation processes.

TPP61011	**FOOD MATERIAL SCIENCE**	**3 CREDITS (3-0)**
This course discusses food commodities characteristics, including egg, dairy, meat/muscle foods, fish, tubers, legumes, cereals, spices, seaweeds, fruits, vegetables, and food estate products (cocoa, coffee, tea, palm, and others), and other commodities. The discussions comprise the main chemical components and their characteristics, structural properties, postharvest physiology, and their relationship to processing and utilization.		

TPP62006	**NUTRITION EVALUATION**	**2 CREDITS (2-0)**
This course covers integrate nutrition contained in food and those advantages in the human body. Some factors affect the nutritional value of food (antinutritional compounds, processing effects, nitrification, etc). Evaluation methods of the nutritional value of food by 'in vivo' and 'in vitro.' Moreover, the introduction of laboratory animal handling.		

TPP62007	**FOOD MICROBIOLOGY 2**	**2 CREDITS (2-0)**
This course covers pathogenic microorganisms, infection, intoxication, mycotoxin, viruses, parasites, Host -microbes interaction, microorganisms' role in disease and immunity, and various physical and chemical methods to control pathogenic microorganisms in foods.		

TPP62008	**FOOD ANALYSIS**	**3 CREDITS (3-0)**
This course is about chemical and physical analysis of foods, that covers sample pre-treatment (size reduction, sieving, etc), sampling techniques,		

extraction techniques; a brief explanation about conventional and modern-sophisticated analysis; qualitative and quantitative analysis in food analysis; principles of proximate analysis including proteins, carbohydrates, fats and oils, water, vitamins, minerals, and analysis of pigments, antioxidants, anti nutrition, food additives, and toxicants; basic principles of chromatography, electrophoresis, and ELISA in food analysis; application of microscopic analysis in foods; and physical analysis of foods including color, texture profile analysis, rheology.

TPP62009	**LABORATORY WORK OF FOOD BIOCHEMISTRY AND ANALYSIS**	**2 CREDITS (0-2)**
The laboratory work is designed to give a hands-on laboratory and practical experience to increase students' understanding of the qualitative biochemical molecules analysis. Changes due to enzymatic processes, carbohydrates, proteins, and fats were analyzed: enzyme extraction, activity assays, and enzyme kinetics. Sampling techniques, analysis of levels and characteristics of the protein, carbohydrates, fats, water, vitamins, minerals, antinutritional substances, additives, the physical properties of food products (color, viscosity, texture, elasticity) analysis are also practiced.		

TPP62010	**FOOD ENGINEERING 3**	**3 CREDITS (3-0)**
This course is about studying basic thermal process principles and applying food engineering principles in evaporation, refrigeration, freezing, distillation, extraction, membrane separation, filtration, and centrifugation.		

TPP62011	**FOOD PROCESSING TECHNOLOGY**	**3 CREDITS (3-0)**
This course discusses a set of technologies (traditional and modern food preservation methods) used to convert raw materials into food products (good sensory, safe, nutritious, healthy, and met consumer demand), including maintaining food quality during distribution and storage. It also discusses food preservation's necessity, the relationship between factors causing physical, chemical, and microbiological damage with water. The process technologies studied are the principles and examples of applications of material cleaning, sorting, grading, blending, size reduction, mixing, emulsification, filtration, centrifugation, extraction, heat processing		

(blanching, pasteurization, sterilization, baking, frying, roasting, extrusion, evaporation, drying), fumigation, cooling, freezing, crystallization, non-thermal processing (chemically, salting, acidification, fermentation / enzymatic) and irradiation.

TPP62012	**LABORATORY WORK OF FOOD PROCESSING TECHNOLOGY**	**2 CREDITS (0-2)**
The laboratory work includes basic processing methods such as density measurement, rheology measurement, WHC measurement, syneresis, drying technology, thermal processing technology, bakery technology, cooling and freezing technology, frying technology, preservation technology by using sugar, salt, acid, and other preservatives and intermediate moisture food (IMF) technology.		

TPP62013	**SANITATION AND WASTE TREATMENT**	**3 CREDITS (3-0)**
The definition of food industry sanitation includes sanitation of food production area, processing tools, water, worker, fresh material, and industrial environment. Pest management and water supply in the food industry. Continuous technology design for wastewater and solid waste treatment, sanitary landfill, and harmful waste treatment, recycling technology: reduction of wastewater nutrition, energy production from wastewater and solid waste, product recovery.		

TPP62014	**QUALITY MANAGEMENT SYSTEM AND HALAL ASSURANCE**	**2 CREDITS (2-0)**
This course covers the concepts and the definition of quality, its history, quality terminology, quality management system, quality audit, certification, and accreditation. It is expected that students will establish quality documents, quality manuals, and quality standards, including a halal quality management system.		

TPP62015	**ENZIMOLOGY**	**2 CREDITS (2-0)**
This course covers enzyme characteristics as a biocatalyst, nomenclature system, and classification of the enzyme. The role of the enzymes in living		

process and food processing. Structure of enzyme, kinetics of enzymatic reaction, mechanism of enzymatic action

TPP61012	**EXPERIMENTAL DESIGN**	**2 CREDITS (2-0)**
This course covers research variable and parameters identification and how to design an experimental work, such as completely randomized design, completely randomized block design, nested, factorial, and optimization. Both parametric and non-parametric approaches will also be studied. The non-experimental work structure will also be explained, including managing data collection, relevant statistical analysis, and interpretation.		

TPP61013	**LABORATORY WORK OF NUTRITION EVALUATION**	**1 CREDITS (0-1)**
This course covers 'in vitro' methods to evaluate food and nutrition quality, bioavailability, processing effects, and antinutritional. Also, it includes the basic skills of laboratory animal handling.		

TPP61014	**LABORATORY WORK OF FOOD MICROBIOLOGY**	**2 CREDITS (0-2)**
This laboratory work is designed to provide practical ability in food microbiology analysis. General techniques and standard procedures for microbiological analysis, isolation and identification of microorganisms, microbial biochemical activity tests, the effect of food processing on microorganism resistance, microbial control by chemical treatment, food preservation through the fermentation process.		

TPP61015	**SENSORY ANALYSIS**	**2 CREDITS (2-0)**
This course covers the basics and fundamental sensory science and technical aspects of basic sensory methodology, including discriminative test, preference test, acceptability test, and descriptive test. Relevant statistical analysis related to the experimental design of the test will be required to master.		

TPP61016	**LABORATORY WORK OF SENSORY ANALYSIS**	**1 CREDIT (0-1)**
The students will understand sensory evaluation, including difference test,		

preference and acceptability test, and descriptive test. Sensory threshold measurement will also be conducted. Not only demonstrate the test, but it is also expected that relevant statistical analysis will be mastered.

TPP61017	**QUALITY CONTROL**	**2 CREDITS (2-0)**
This course covers the conceptual and definition of quality, operational scope of quality control, the relevance of quality and controlling process, quality attributes, and standards. The scope is emphasized on the practical aspect of quality control, particularly on the quality control tools and statistical process control using a computer application.		

TPP61018	**FOOD ADDITIVES AND INGREDIENTS**	**3 CREDITS (3-0)**
This course contains food additives, including preservatives, emulsifiers, stabilizers/thickeners, artificial sweeteners, food coloring, acid, flavor, antioxidants, and other food additives such as developers, anti-clumping, and others. Discussion include: type, chemical structure, the function of the product, physical and chemical properties, mechanism of action, mode of use, usage limits and safety aspects, as well as nutrition of specific food components in food products. This course also discusses the characteristics and application of various ingredients widely used in the food industry. The discussion also covers related regulations and standards. *The learning process is emphasized on the ability to determine its use in food production and be able to do problem-solving related to the use of materials in food processing. Knowledge of industrial materials learned includes: milk derivatives (skim milk, cream, buttermilk, anhydrous milk fat, casein, whey, etc.), starch, modified starch, dextrin, maltodextrin, flour, sugar alcohol, sugar (high fructose syrup, glucose/dextrose, lactose, high corn syrup, etc.), industrial ingredients of meat products including curing agent, vegetable oils/fats (cocoa butter, cocoa butter substitute, partially hydrogenated vegetable oil, coconut oil, soybean oil, frying fat, etc.), fortification food, premix vitamins and minerals for fortification and processing, eggs and their derivatives, oligosaccharides, prebiotics, probiotics, isolates and protein concentrates, enzymes for processing (rennet, protease), seasoning, lecithin, and other food industry materials.*		

TPP61019	FOOD PACKAGING AND STORAGE	3 CREDITS (3-0)
This course is about the knowledge of various packaging materials (plastic, paper, metal, and glass), their properties (resistance to heat, permeability to gas and water), and various packaging and application methods. This course also studies about determination of food products shelf life by reaction prediction methods and shelf life plots (Arrhenius, linear, and Q10), etc.		

TPP62016	PRODUCT DEVELOPMENT	2 CREDITS (2-0)
This course covers the necessity of new product development and dicusses socio-cultural aspect. The study of consumer behavior, consumer research, the principles of management of new product development, design new products, technology and engineering in new product development, business aspects in the development of new products that include financial forecasting and market opportunities for new product development, the latter part of the lecture discussed several case studies and discussion of subjects covered by the review. Measurement of sensory characteristics. Testing of products in the development and marketing stage.		

TPP62017	FOOD REGULATION	2 CREDITS (2-0)
This course is designed to increase national and international food regulation and their respected bodies/agencies. Food claim, adulteration as well as food safety aspects are within the scope of the subject. Current issues in food trade, including its system and procedure, are also elaborated.		

TPP62018	FOOD SAFETY AND TOXICOLOGY	3 CREDITS (3-0)
This course contains the concept of toxicology, the classification of toxic materials in foods (natural animal, plant, microbe toxin, environmental toxicants, heavy metals, pesticides, etc.). This course also teaches about the mechanisms of toxicity include absorption, distribution, and metabolism. Furthermore, this course teaches about food allergens, food additives, and detoxification mechanisms (biotransformation).		

TPP62019	FOOD PROCESSING UNIT DESIGN	4 CREDITS (3-1)
The course covers the theories underlying the planning process of a processing unit, process flow diagram, mass balance and heat balance, the need for processing tools and machinery, utilities, management of occupational quality, safety and economic analysis, and its application in practice for planning processing unit.		

d. Elective Courses

TPP61020	ANIMAL PRODUCT PROCESSING TECHNOLOGY	3 CREDITS (3-0)
Characteristics and physiological properties of animal products of food. Postharvest handling techniques of livestock and fish product for consumption and raw material. Processing techniques of livestock and fish product into refined products that have economic value. Handling techniques and industrial waste treatment and processing of livestock and fish industry.		

TPP61021	NUTRACEUTICALS AND FUNCTIONAL FOODS	2 CREDITS (2-0)
This course is a study of supplements and functional health food. The discussion also includes bioactive food components to develop supplement products and functional food, especially those based on local resources. Aspects include: the relationship between food, nutrition, and health; the efficacy of the bioactive component in preventing health problems; types of supplement products and functional foods; Regulation, prospects, and trends of supplements and functional food.		

TPP61022	CULINARY MANAGEMENT	2 CREDITS (2-0)
This course covers basic knowledge of the scope and development culinary including food services, culinary industry and catering services. The aspects discussed cover quality, nutrition and economic aspects including the provision of materials, menu planning, processing and preparation for		

presentation, design and layout, organization, personnel, and marketing. In addition, this course also discusses aspects of meal experience and satisfaction in culinary industry as well as its testing methods.

TPP61023	**PLANTATION CROP PRODUCT TECHNOLOGY**	**2 CREDITS (2-0)**
This course discusses the handling and processing technology of plantation crops such as processing cocoa, tea, coffee, coconut, oil palm. Technology for handling fresh commodities and their processed products.		

TPP61024	**POLYSACCHARIDES AND SUGAR TECHNOLOGY**	**2 CREDITS (2-0)**
This course explains the various types of polysaccharides, natural resources of polysaccharides, specific characteristics and their functions in food products. Also discusses about the hydrolysis method of some polysaccharides into sugar. Natural and alternative sugar sources, the effect of sugar on the characteristics of food products.		

TPP61025	**FATS AND OILS TECHNOLOGY**	**2 CREDITS (2-0)**
This course contains technology and processing of fats/oils source, processing fats/oils source into edible fats/oils and their derivative product. Edible fats/oils topic consist of principle of technology/method, machine, extraction process, purification (degumming, refining, washing, bleaching, deodorization, fractionation). Derivative product of fats/oils consist of technology, processing equipment, controlling process, applied product (butter, margarine, shortening, frying fats, virgin coconut oils or VCO, cocoa butter substitute/replacer/alternative, fat replacer/ mimetic, hydrogenated fats, salad oil, fish oil, creamer, medium-chain triglyceride or MCT)		

TPP61026	**SNACK AND CANDY TECHNOLOGY**	**2 CREDITS (2-0)**
This course discusses about the processing technology of some snacks and confectionery, the components of making snacks and candy, ingredients used, the role of snacks and in healthy food patterns and consumer's need for healthy snack and candy.		

TPP61027	MOLECULAR GASTRONOMY	2 CREDITS (2-0)
This course is designed to understand molecular gastronomy and its relevance to food science. The topics include gastronomy, sensory perception mechanism, physical-chemistry and engineering aspects of cooking and application of molecular cooking techniques and advanced cuisine to optimize eating and drinking experience		

TPP61028	INNOVATIVE FOOD TECHNOLOGY AND ENGINEERING	3 CREDITS (3-0)
This course covers a study of a novel processing technique to obtain healthier and safer food products, including non-thermal processing, encapsulation, emulsification, nanotechnology, microwave applications, ohmic heating, electrochemical technique, and novel materials for food, including bio-surfactant and catalyst.		

TPP61029	SPICES AND ESSENTIAL OILS TECHNOLOGY	2 CREDITS (2-0)
This course discusses various types of spices and their functions for food and health, the effects of processing on their functional properties, methods of extracting essential oil and products that can be developed from the processing of essential oils.		

TPP61030	THERMOBACTERIOLOGY	2 CREDITS (2-0)
The course introduces important aspects in thermal treatment of food material so that a food product is safe to eat and retaining nutrients. The course will be opened by introduction to history and development of thermal process application in food products and continued with the microbial aspects that are important in thermal processes, including microbial resistance to thermal processes At a half of semester the course will be followed by strengthening evaluation of thermal process.		

TPP61031	FERMENTED FOODS	3 CREDITS (3-0)
This course provides basic knowledge on processed products that process using microbes. Processing and fermentation of processed product development, both traditional and modern, includes fermentation of fruits		

and vegetables, cereals, tubers and grains, and animal products. Ways to control the process, the determination of the quality of the final product. Fermentation based functional foods.

TPP62020	**POST HARVEST PHYSIOLOGY AND TECHNOLOGY**	**2 CREDITS (2-0)**
The course discusses about fresh commodity physiological process include description about respiration and respiration pattern. Effect of respiration pattern on commodity shelf life, transpiration, physic-chemical alteration during maturation of product. Effect of temperature, RH and gas composition on commodity physiology, pathology, postharvest loss, and quality standard.		

TPP62021	**COMMUNITY NUTRITION AND PUBLIC HEALTH**	**2 CREDITS (2-0)**
This course is a study about on Community Nutrition Issues and Food Security, Nutrition Improvement and Foo Diversification Program, Nutrition Epidemiology, Balanced Menu, and Desirable Dietary Pattern. Explain the calculation of nutritional needs and adequacy (RDA) and nutrition for particular groups. Community nutritional status assessment methodology. Overview of malnutrition, degenerative diseases, and public health indicators.		

TPP62022	**TRENDS IN FOOD AND NUTRITION**	**2 CREDITS (2-0)**
This course is a study about the latest trends in food, nutrition and health technology. This course includes coverage of the immune system, cancer, vegetarian diet, sport nutrition, food security and malnutrition, fat burning food, food and diabetes, emergency food, food and anti-aging, nutrigenomics, and gastronomy nanotechnology in nutrition, and other actual issues.		

TPP62023	**FOOD AND NUTRITION INTERVENTION**	**2 CREDITS (2-0)**
This course discusses the principles and concepts of planning, organizing, implementing, and evaluating nutrition and food intervention programs in		

solving problems in the community. This course also examines the concepts of behavior and socio-culture concerning nutrition and health issues; intervention methods and strategies; design material, media, assessment, and intervention approach techniques (individual, group, and mass).

TPP62024	**CONSUMER STUDY**	**2 CREDITS (2-0)**
This course is designed to introduce awareness of principal theories related to consumer behavior, detailed aspects of consumer background and market decision, as well as the current issue of food market changes. The general method for consumer study is also discussed		

TPP62025	**NATURAL PRESERVATIVES**	**2 CREDITS (2-0)**
This course studies the history of food preservation, food preservation methods, food preservatives, factors that affect the effectiveness of preservatives, the dangers of synthetic preservatives and the benefits of natural preservatives, natural preservatives based on microbial, natural preservatives based on plant, natural preservatives based on animals, food products which utilize preservatives.		

TPP62026	**FOOD CROP PROCESSING TECHNOLOGY**	**3 CREDITS (3-0)**
This course discusses various local crop commodities and their specific characteristics, fresh handling, processing technology, and processed products based on food crop commodities.		

TPP62027	**HORTICULTURAL PRODUCT TECHNOLOGY**	**3 CREDITS (3-0)**
This course deals with various methods for processing fruit and vegetables, physical and chemical changes during processing, fruit beverage products, dried fruit and vegetables, fruit and vegetable flour, fruit peel pigments extraction, and fruit and vegetable fermentation.		

TPP62028	**FOOD AND NUTRITIONAL BIOASSAY**	**2 CREDITS (2-0)**
This course introduces some bioassay techniques to test the biological activity of of nutrient compounds (macro and micro-nutrients) and bioactive		

compounds. The technique methods to be studied are in vivo and in vitro models. Some basic principles in vivo experiments are introduced, such as animal used, feeding methods, feed formulation, animal induction methods, animal handling, euthanasia techniques etc. In vitro methods such as using cell line, primer cells from organ body, etc are also introduced

TPI62061	OCCUPATIONAL SAFETY AND INDUSTRIAL ENVIRONMENT	2 CREDITS (2-0)
This course contains some concepts and principles in Occupational Safety and Health (K3), K3 management system, contaminant sources and their prevention, sanitation of production spaces and environment, and improved production spaces zone.		

2) The Bachelor of Biotechnology

The description and CLOs of the courses managed by the program are given as follows.

TPB61001	MATHEMATICS	3 CREDITS (3-0)
Study the basics of sequences and series, matrices, functions and relations. *After completing this course, students should be able to:* *1. Solve basic and applied mathematical problems.* *2. Explain the importance of mathematics in industrial biotechnology.*		

TPB61002	INTRODUCTION TO BIOTECHNOLOGY	3 CREDITS (3-0)
Study the scope of biotechnology, its role in industry and sustainability, as well as its regulation. *After completing this course, students should be able to:* *1. Explain the role of biotechnology in various industries and in supporting sustainable development.* *2. Explain the principles underlying the regulation of biotechnology.*		

TPB62001	GENETICS	2 CREDITS (2-0)
Study the basics of inheritance and kinship relationships between biomass taxa (viruses, archaea, bacteria, protists, fungi, Animalia, and Plantae).		

After completing this course, students should be able to: *1. Compare the basis of inheritance across taxa.* *2. Classify biomass based on their taxa and make models of their phylogenetic tree using software.*

TPB62002	INTRODUCTION TO BIOPROCESS ENGINEERING	2 CREDITS (2-0)
Study the scope and industrial applications of bioprocess engineering. *After completing this course, students should be able to:* *1. Explain the principles of industrial fermentation.* *2. Explain the principles of upstream and downstream processing in bioindustries.*		

TPB62003*	PRINCIPLES OF BIOPROCESS ENGINEERING	3 CREDITS (3-0)
Study the principles of engineering in bioprocess operations. *After completing this course, students should be able to:* *1. Calculate heat and mass transfer in bioprocess applications.* *2. Explain the principles and applications of mass and energy balance, fluid flow as well as heat and mass transfer in biotech industries.*		

TPB61003	BIOCHEMISTRY AND ENZYMOLOGY LAB WORK	1 credit (1-0)
Practice the isolation and analyses of biomolecules in the lab. *After completing this course, students should be able to:* *1. Examine the steps in the isolation and analyses of biomolecules.* *2. Interpret and report the results of biomolecule isolation and analyses.* *3. Demonstrate the isolation and analyses of biomolecules.*		

TPB61004	ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY	2 CREDITS (2-0)
Study the principles of biotechnology analyses. *After completing this course, students should be able to:* *1. Compare analytical techniques in biotechnology for specific purposes.* *2. Explain the principles of analytical techniques in biotechnology.*		

TPB61005	ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY LAB WORK	1 CREDIT (1-0)

Practice analytical techniques in biotechnology in the lab.
After completing this course, students should be able to:
1. *Examine the steps in biotechnology analyses for specific purposes.*
2. *Interpret and report the results of biotechnology analyses.*
3. *Demonstrate analytical techniques in biotechnology.*

TPB61006	MOLECULAR AND CELL BIOLOGY	3 CREDITS (3-0)

Study the structure, organization, and function of genetic material, proteins, and cells; the process and regulation of replication, transcription, and translation; and the life cycles of cells.
After completing this course, students should be able to:
1. *Compare the molecular machineries and mechanisms that give rise to the characteristics of prokaryotic and eukaryotic cells.*
2. *Compare the life cycles of prokaryotic and eukaryotic cells.*

TPB61007*	BIOPROCESS UNIT OPERATIONS 1	2 CREDITS (2-0)

Study the unit operations for upstream and downstream processing in bioindustries.
After completing this course, students should be able to:
1. *Examine the principles of various unit operations for upstream and downstream processing.*
2. *Solve unit operation problems in upstream and downstream processing.*

TPB61008*	BIOPROCESS UNIT OPERATIONS 2	3 CREDITS (3-0)

Study the principles of reactions and reactor engineering in bioindustries.
After completing this course, students should be able to:
1. *Examine the design principles of various bioreactors.*
2. *Solve homo- and heterogeneous reaction problems.*

TPB62004	INTRODUCTION TO BIOINFORMATICS	2 CREDITS (2-0)

Explore biological databases and use software to analyze the data.
After completing this course, students should be able to:

1. *Compare gene and protein sequences using software and present the data.*
2. *Extract, interpret, and annotate gene and protein sequences from biological databases using software.*

TPB62005	GENETIC ENGINEERING	3 CREDITS (3-0)

Study the principles and applications of genetic engineering on microorganisms.
After completing this course, students should be able to:

1. *Design plasmids for specific purposes using software.*
2. *Explain the principles and applications of genetic engineering on microorganisms.*

TPB62006	GENETIC ENGINEERING LAB WORK	1 credit (1-0)

Practice the engineering of microorganisms in the lab.
After completing this course, students should be able to:

1. *Examine the steps in engineering microorganisms.*
2. *Interpret and report the results of genetic engineering experimental data.*
3. *Demonstrate genetic engineering techniques.*

TPB62007	ENZYME TECHNOLOGY	3 CREDITS (3-0)

Study the discovery, engineering, production, and application of enzymes in various industries and their regulation.
After completing this course, students should be able to:

1. *Examine the biocatalysis cycle (from enzyme discovery to industrial application and its regulation).*
2. *Compare the application of enzyme technology in various industries.*

3.	*Explain the safety and regulatory aspects of enzyme production.*

TPB62008	INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY	2 CREDITS (2-0)
Study the derivatization and conversion of biomass into bioproducts as well as their sustainable management. *After completing this course, students should be able to:* 1. *Create industrial trees based on biomass and the potential bioproducts that can be produced from biorefinery processes.* 2. *Explain good practices (from raw material handling, manufacturing to waste treatment) that support bioindustries' sustainability.*		

TPB62009	INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY LAB WORK	1 credit (1-0)
Practice the conversion of biomass to bioproducts and analyze the quality of the bioproducts. *After completing this course, students should be able to:* 1. *Examine the steps in biomass-to-bioproduct conversion and analyses.* 2. *Interpret analytical data related to the quality of bioproducts and report the results.* 3. *Demonstrate biomass-to-bioproduct conversion and analytical techniques.*		

TPB62010	PRODUCT DEVELOPMENT AND REGULATION IN BIOTECHNOLOGY	3 CREDITS (3-0)
Study the principles of biotechnology product development and the regulation of biotechnology products. *After completing this course, students should be able to:* 1. *Develop biotechnology product ideas.* 2. *Explain the regulatory system for biotechnology products.*		

TPB61009	BIOPROCESS UNIT DESIGN	3 CREDITS (3-0)
Study the design principles of bioprocessing plants.		

After completing this course, students should be able to: *1. Design a bioprocessing plant.* *2. Calculate the feasibility of a bioprocessing plant design.*

TPB61010	**EXPERIMENTAL DESIGN**	**2 CREDITS (2-0)**
Study the principles of experimental design for the final student project. *After completing this course, students should be able to:* *1. Design experiments to answer a hypothesis.* *2. Compare different types of experimental design and their applications.*		

TPB61011	**SEMINARS IN BIOTECHNOLOGY**	**2 CREDITS (2-0)**
Study effective scientific communication techniques for the student's final project. *After completing this course, students should be able to:* *1. Make effective tables and figures.* *2. Make an effective poster.* *3. Present research ideas effectivelly.*		

TPB61012	**IMMOBILISATION TECHNIQUES**	**2 CREDITS (2-0)**
Study the techniques of immobilizing biological agents and their industrial applications. *After completing this course, students should be able to:* *1. Compare biological agent immobilization techniques and their applications in biotech industries.* *2. Explain the principles and techniques of immobilization as well as the factors that influence immobilization performance.*		

TPB61013	**APPLIED MICROBIOLOGY**	**3 CREDITS (3-0)**
Study the trends in applied microbiology in various fields. *After completing this course, students should be able to:* *1. Examine the latest trends in applied microbiology.* *2. Explain the applications of microbiology in various fields.*		

TPB61014	FOOD BIOTECHNOLOGY	2 CREDITS (2-0)

Study the application of modern genetics and biochemical processes (enzymatic and metabolic) in food products and their development trends.
After completing this course, students should be able to:
1. *Examine traditional foods made using biotechnology.*
2. *Explain the development of biotechnology applications in food products and their effects on product quality and safety.*

TPB61015	NUTRIGENOMICS	2 CREDITS (2-0)

Study the concept of nutrigenomics and its application for disease prevention and therapy.
After completing this course, students should be able to:
1. *Examine the latest scientific literatures to provide unbiased explanations on nutrigenomics-related controversies or opinions or claims.*
2. *Explain the relationship between nutrition, genome, and human health.*

TPB61016	INTRODUCTION TO IMMUNOLOGY	2 CREDITS (2-0)

Study the components and mechanisms of action as well as diseases caused by responses or abnormalities of the immune system.
After completing this course, students should be able to:
1. *Compare innate and adaptive immune systems and their roles in the etiology of diseases.*
2. *Explain the applications of immunology in health industries.*

TPB62011	ENVIRONMENTAL BIOTECHNOLOGY	3 CREDITS (3-0)

Study the application of biotechnology to address environmental problems.
After completing this course, students should be able to:
1. *Assess environmental problems and make recommendations for handling them using biological processes.*
2. *Compare technological applications for addressing environmental*

problems.

TPB62012	BIOSENSORS	2 CREDITS (2-0)
Study the principles of biosensor development and their applications. *After completing this course, students should be able to:* *1. Compare the performance of biosensors in various fields.* *2. Explain the components, principles, and fabrication methods of biosensors.*		

TPB62013	NANOBIOTECHNOLOGY	2 CREDITS (2-0)
Study the principles of nanobiotechnology and its applications in various fields. *After completing this course, students should be able to:* *1. Compare the applications of nanobiotechnology in various fields.* *2. Explain nanomaterials' (physical and chemical) properties, methods and devices for fabricating nanomaterials, and their measurements.*		

TPB62014	PROTEIN BIOTECHNOLOGY	2 CREDITS (2-0)
Study the latest developments in protein biotechnology and its potential applications in various fields. *After completing this course, students should be able to:* *1. Examine the latest scientific literature on protein biotechnology.* *2. Explain the potential applications of protein biotechnology in various fields.*		

TPB62015	BIOPHARMACEUTICALS	2 CREDITS (2-0)
Study the principles of bio-based drug development and production processes. *After completing this course, students should be able to:* *1. Examine the process of decision making and the risk of failure in developing bio-based drugs.* *2. Explain the principles of bio-based drug specification determination and production processes.*		

TPB62016	AROMATIC TECHNOLOGY	2 CREDITS (2-0)
Study the applications of natural products in the aroma and cosmetic industries. *After completing this course, students should be able to:* 1. *Explain the role and development of biotechnology in the aroma and cosmetic industries.* 2. *Explain techniques for the bioprospecting, production, and quality control of aroma and cosmetic compounds.*		

5.1.2 DEPARTMENT OF AGRICULTURAL ENGINEERING

1) The Bachelor of Agricultural Engineering and Bio-system

1. Course Syllabus

MPK60001	EDUCATION OF ISLAMIC RELIGION	2 CREDITS (2-0)
Al-Qur'an and Science. The origin of life, human, earth, and the universe. Human and Religion. Status and function of the human, objectives, and program of human life. The role of religion in human life, kinds of religion. A review of religion other than Islam. The Islamic Aqidah; The outlines of Islamic teaching. Understanding and urgency of Tauhid, the discussion about Arkanul Iman, faith benefits. The Islamic Syari'ah; Understanding the Islamic syari'ah, Islamic shari'ah sources, discussion about Arkanul Islam, mu'amalah. Akhlaq Al-Islam; Understanding morality, good moral and akhlaqul madsumumah. Capita Selecta; The history of Islam.		
Course Learning Outcomes (CLO): 1. *Able to understand and implement monotheism in life* 2. *Able to understand the meaning, scope, principles and functions of Islamic law.* 3. *Able to understand the importance of Islam rahmat lil 'alamin in the nation and state* 4. *Able to understand religious tolerance in Indonesia* 5. *Able to understand as a mosque the center of Muslim civilization* 6. *Able to understand the dangers and negative impacts of corruption* 7. *Able to understand the government system from an Islamic perspective* 8. *Able to apply Islamic values that are religious, honest, disciplined,*		

tolerant and fair 9. *Able to be responsible in carrying out daily life in accordance with their duties as servants of Allah and caliphs (leaders) on earth.* 10. *Able to analyze the importance of holding power as a mandate with full justice* 11. *Able to fortify themselves from anti-Pancasila and NKRI movements.*

MPK60002	EDUCATION OF CATHOLIC RELIGION	2 CREDITS (2-0)
This course Improves understanding of the faith concept in the Church, life with the church behavior and socialized to develop personal attitudes of a Catholic scholar who can devote himself to the interests of the Indonesian people as an expression of his faith. ***Course Learning Outcomes (CLO):*** 1. *Able to describe the scope of Catholic religious education* 2. *Able to explain the Preaching of Jesus Christ* 3. *Able explain the Apostles' stories and Al Kitab* 4. *Able to explain the history of Catholicism* 5. *Able to explaining Christian Life in society*		

MPK60003	EDUCATION OF PROTESTANT CHRISTIAN RELIGION	2 CREDITS (2-0)
Develop the application of Christian faith foundations to equip students so that able to grow as a whole person and a new creation in Jesus Christ. Improve accountability to God through his sensitivity toward others and their environment. Thus as academic human should go to the community by the dedication based on the service and honor and glory of God. ***Course Learning Outcomes (CLO):*** 1. *Able to describe the scope of Protestant Christian education* 2. *Able to explain the concept of divinity in Protestant Christianity* 3. *Able to explain the concept of man in Christianity* 4. *Able to explain Law in Christianity*		

MPK60004	HINDUISM EDUCATION	2 CREDITS (2-0)

History of Hinduism, Three basics framework of Hinduism, tatwa (philosophy), susila (ethics), yadya (ritual). Wada's description, the basic belief of Hinduism, panca srada, basic and purpose of human life, dharma Sidhartha, catur marga yoga, panca maha yadya, catur asram, catur warna.

Course Learning Outcomes (CLO):

1. *Able to describe the scope of Hindu religious education*
2. *Able to explain Sradha, Susila, Yadnya, and Scripture*
3. *Able to explain describe of Saints and holy places*
4. *Able to explain cultural and historical development*

MPK60005	BUDDHISM EDUCATION	2 CREDITS (2-0)

Inception of Buddhism, epistemology, causality, life characteristic, rebirth karma, morality and ethics, nirvana, branching and characteristic of each stream, metaphysics, theology in Buddhism, Buddhist position in the repertoire of human knowledge, the relevance of Buddhism with modern times and the development era of Indonesia.

Course Learning Outcomes (CLO):

1. *Able to explain describe of the scope of Buddhist education*
2. *Able to explain the history of the establishment of Buddhism*
3. *Able explains Buddhist belief (Saddha), Bhavana, and the law of karma*
4. *Able to explains describes the 31 of existence*

MPK 60006	CIVIC EDUCATION	2 CREDITS (2-0)

Citizenship education has the aims to develop knowledge, understanding, and awareness of National Defense Security (HANKAMNAS) among the students within the framework of National Defense (TANNAS), in addition to develop and raise the awareness of national discipline. Hence, it is given to students the knowledge and understanding of Civics

Education, Archipelago, National Security and Defense Strategy National Security Politics as a cornerstone in understanding the system of People's Defense and Security.

Course Learning Outcomes (CLO):

1. *Able to understand the nature of civic education in development full ability of a scholar or professional and linking the values of Pancasila with the subject matter in the Citizenship Education course.*
2. *Able to interpret the concept of the Unitary State of the Republic of Indonesia and identify as well recognize the uniqueness of the Indonesian rule of law that is rooted in the values of Pancasila.*
3. *Able to understand the supremacy of the constitution and the uniqueness of the State Constitution of the Republic of Indonesia 1945 which is rooted in the values of Pancasila and sorting out constitutional behavior and institution in the life of the nation and state.*
4. *Able to understand, identify, and defend national identity from popular culture in the flow of globalization.*
5. *Able to build awareness and believe in the importance of involvement or participation in the practice of Pancasila democracy.*
6. *Able to study Pancasila as the philosophical foundation of Human Rights in the State Indonesia and compromise between human rights and obligations in the life of the nation and patriotic.*
7. *Able to understand geopolitical and geopolitical concepts in Indonesia and classify the potential for diversity of natural resources and human resources in the concept of regional autonomy based on insights Archipelago.*
8. *Able to show a sense of love for the country, have nationalism, and a sense of responsibility to the state and nation.*

MPK 60007	INDONESIAN LANGUAGE	2 CREDITS (2-0)

The course discusses grammar, syntax, spelling, systematic scientific article writing, usage of standard terms, foreign and local language transformation, and method of summary.

Course Learning Outcomes (CLO):

1. *Able to show a positive attitude and love the Indonesian language by*

applying it in communication effective in an academic environment.

2. *Able to understand and apply various languages in accordance with the context of use in formal / non-formal communication in the scientific field.*
3. *Able to critically read scientific field texts by relating them to previous schemata and contexts.*
4. *Able to evaluate texts in scientific and popular writing in accordance with correct grammar and spelling rules*
5. *Able to explore creative and innovative ideas in writing scientific or polular scientific works.*
6. *Able to produce scientific or popular writings systematically, logically, and empirically suitable for publication in journals and mass media.*

MPK60008	**PANCASILA**	**2 CREDITS (2-0)**
Pancasila courses are national compulsory courses that are included in the personality development course family. . This subject is required with the following backgrounds: (a) Historicality; as a nation that values history, the life of the nation and state can never be separated from the values instilled by the founding fathers; (b) Cultural; as a nation that has cultural roots and values, we must have a solid cultural foundation so that the national identity does not become extinct. (c) Juridical; in the statute of Universitas Brawijaya, it states the need to preserve the values of Pancasila; (d) Global Era, the various ideologies of the world that enter our lives can influence our view of the life of the nation and state, and even threaten the division of the nation, so that a philosophical basis for the state is needed.		
Course Learning Outcomes (CLO): 1. *Able to analyze, compare, and reflect on the function and importance of Pancasila in the history of the nation* 2. *Able to analyze the relationship between the philosophical nature of the values of the Pancasila principles and use them as a tool for analyzing the nation's problems.* 3. *Able to show a positive attitude and love the ideology of the Indonesian nation by applying the values of Pancasila in the*		

academic environment 4. *Able to understand, identify, and be accountable for the analysis of laws and regulations and policies that are idealistic, practical and pragmatic based on Pancasila* 5. *Able to build awareness of critical and innovative thinking in the development of science and technology based on the values of Pancasila*

UBU60004	ENGLISH LANGUAGE	3 CREDITS (3-0)
Ability to active communicate (oral and written) and also passive communicate (listening and reading) in English. Formal and informal oral presentation. Writing a scientific article/ report/ research. English for career purpose (job interview, writing job application, curriculum vitae etc.). ***Course Learning Outcomes (CLO):*** 1. *Able to describe the scope of English* 2. *Able to apply english Listening techniques* 3. *Able to apply basic english speaking / conversation* 4. *Able to apply reading techniques in English* 5. *Able to apply english writing techniques* 6. *Able to know and apply English grammar* 7. *Able to know and be able to prepare for the TOEIC / TOEFL / IELTS English test*		

UBU60001	BACHELOR THESIS	6 CREDITS (6-0)
The thesis is a scientific work of implementation research (in the form of experiments and surveys) or scholarly reports of internship activities equipped with library research, under the supervisor's guidance. *Prerequisites: Have achieved at least 120 credits (proposal)* ***Course Learning Outcomes (CLO):*** 1. *Able to formulate problems* 2. *Able to search scientific literature and compile it systematically* 3. *Able to develop or design scientific activities* 4. *Able to analyze data, process, and interpret data* 5. *Able to discuss the results of data processing and interpretation*		

6. *Able to draw conclusions from a discussion result* 7. *Able to present scientific thesis in written form* **8.** *Able to present orally the final thesis plan and thesis implementation results*

UBU60005	STUDENT COMMUNITY SERVICE (PKM)	4 CREDITS (4-0)
Student Community Service (KKN) is a community service activities in certain areas, it is carried out in groups, integrated between the Department, coordinated in the Faculty level, preferred non-physical activities in agriculture, aims to help people to improve their knowledge and skill that it is expected to improve their welfare. The activity is divided into 4 stages of activity: provisioning, implementation of activities at the site, and reports of the implementation and evaluation. *Prerequisites: Have taken at least 110 credits.* ***Course Learning Outcomes (CLO):*** 1. *Able to manage and cooperate with other disciplines* 2. *Able to identify potentials and problems that exist in partners / communities* 3. *Able to design partner / community empowerment according to local potential and based on local wisdom* 4. *Able to carry out partner / community empowerment programs based on local potential* 5. *Able to communicate with partners / communities in accordance with local manners and norms* 6. *Able to compile program activity and accountability reports*		
TPF60016	**INTERNSHIP (PKL)**	**3 CREDITS (3-0)**

Job training in institutions or government agency or private agency or a student who practice his own agricultural cultivation with supervisor's assistance during a certain period. *Prerequisites: Have taken at least 100 credits* ***Course Learning Outcomes (CLO):*** 1. *Able to compile activity plans [field work reacts based on scientific basis in accordance with the student's scientific field* 2. *Able to make observations and analyze the results of observations* 3. *Able to connect theory with real practice in the field* 4. *Able to present observations, analysis of the relationship between theory and practice in the form of scientific writing* 5. *Able to communicate with partners and show professional performance during activities at industries*

TPE 61003	PHYSICS	4 CREDITS (3-1)
The course study about dimension and unit (scalar, vector), Newton Law, Equilibrium. Liquid: hydrostatic properties, molecule phenomena, surface tension. Thermodynamics: thermal and temperature, energy transformation, thermal transformation. Modern physics: quantum theory, nuclear radiation.		

Course Learning Outcomes (CLO):

1. *Able to explain quantities and units and calculate cases related to using vector algebra*
2. *Able to explain and calculate classical mechanics topics for rigid objects*
3. *Able to explain and calculate classical mechanics topics for flow objects*
4. *Able to explain and calculate thermal physics topics*
5. *Able to explain and calculate wave physics topics*
6. *Able to explain and calculate electric and magnetic physics topics*
7. *Able to calculate, demonstrate, and conclude the correct measurement method*
8. *Able to calculate, demonstrate, and conclude the addition of force vectors*
9. *Able to calculate, demonstrate, and conclude Archimedes law experiments*
10. *Able to calculate, demonstrate, and conclude thermal expansion experiments*
11. *Able to calculate, demonstrate, and conclude experiments of ohms and Kirchoff's law*

TPF 61006	PRACTICAL PHYSICS	1 CREDIT (0-1)

This practicum discusses the law of archimdes, bouyanci law. And prove the law in an experiment. And there are experiments on electrical circuits to find out the value of Ohm (resistance), current, and voltage. Kurchoff's law is also applied to electrical circuits.

Course Learning Outcomes (CLO):

1. *Able to calculate, demonstrate and deduce the correct measurement method*
2. *Able to calculate, demonstrate, and conclude the experiment of adding force vectors*
3. *Able to calculate, demonstrate and conclude Archimedes law experiments*
4. *Able to calculate, demonstrate and conclude thermal expansion experiments*
5. *Able to calculate, demonstrate, and deduce experimental Ohms and Kirchoff's laws*

TPE 62005	AGRICULTURAL SCIENCE AND BIOSYSTEM	4 CREDITS (2-2)
This course covers cultivation techniques to produce plants, which include: Seeds and seedlings of plants. Planting (at medium of soil and non-soil) includes spacing, crop rotation, and cropping patterns. Maintenance of the plant to support crop production.The role of climate in human life, animals, and plants. Definition and scope of climatology in agriculture. Radiation as an energy source and its benefits for plants and animals. Elements and mechanisms of climate variations on earth's surface climate elements (temperature, humidity, wind, clouds, evaporation, and rain) . Utilization of climate data in the planning of activities in the fields of agriculture, farm buildings and irrigation design. Management and interpretation of climate data. Introduction and interpretation of climate data. The introduction of climate -type classification method. Understanding of the soil. The function of the soil for plant growth. The terms in soil science. Formation and classification of soil. Introduction to physics, chemistry / fertility, and land conversion. Map of soil and land evaluation. (2 credits climatology practicum, soil science practicum, and basic agronomy practicum).		
Course Learning Outcomes (CLO): 1. *Able to explain the environment and understanding of agricultural and biosystem sciences.* 2. *Able to explain and identify the function of soil and its use for plant growth.* 3. *Able to explain and identify the space scope of climatology in the field of agriculture within the meaning broad.*		

TPE 62006	PRACTICAL OF AGRICULTURAL SCIENCE AND BIOSYSTEM	2 CREDITS (0-2)
Practicum discusses the basics of testing the physical properties of soil. Soil properties testing includes moisture content, density, soil density, and soil porosity. Testing is done using a simple testing method. ***Course Learning Outcomes (CLO):*** 1. *Able to explain and conclude cultivation of crops* 2. *Able to calculate, demonstrate, and conclude agricultural*		

	climatology
3.	*Able to explain and conclude about climate and the effect*
4.	*Able explain and conclude explain and conclude*
5.	*Able to calculate, demonstrate, and conclude Utilization of climate data*

TPF 61003	BASIC CHEMISTRY	3 CREDITS (2-1)

General chemistry is designed to introduce the fundamental principles of chemistry, inorganic, physical, and analytical chemistry. In this course, topics studied are understanding of matter, composition, structure of matter element and compound, chemical bonding. It covres atomic theory, solution and concentration, pH solution, oxidation-reduction reaction, electrochemical, chemical equilibrium, kinetics reaction. Stoichiometry, quantitative and qualitative chemical analysis includes volumetric (standard solution, alkalimetric and acidimetric analysis), and gravimetric (precipitation) analysis.

Course Learning Outcomes (CLO):

1. *Able to explain and discuss distinguishing types of substances, compound elements, solutions and mixtures, can explain atomic structure and can understand the periodic system of elements*
2. *Able to formulate, demonstrate and demonstrate technical principles and methods of analysis and control of chemical reactions that occur in agricultural technology*
3. *Able to explain and apply chemical reactions related to damage mechanisms and shelf life of food / agricultural products*
4. *Able to analyze and present the meaning of reaction kinetics, reaction order, reaction rate, able to determine the order of a reaction, able to determine the rate of reaction and rate constants of a reaction, to determine the rate of reaction in an enzymatic reaction*

TPF 61004	PRACTICAL OF BASIC CHEMISTRY	1 CREDIT (0-1)

In this practicum course, students learn about the basic principles of work in the Laboratory. Students learn about the tools in the laboratory and K3 culture. Students are able to make solutions with a certain concentration, principles Alkalimetric acid, buffer solutions, oxidation reduction reactions and concentration determination substances by the spectrophotometric method.

Course Learning Outcomes (CLO):

1. *Able to explain the names and functions of the tools used in practicum*
2. *Able to carry out titration techniques correctly such as determining the end point of the titration and the titration volume*
3. Able to *make a solution from liquid, solid materials, and have accuracy in carrying out the dilution steps*
4. *Able to using a pH meter and use pH meter for calibration*
5. *Able to identify the changes that occur during the reaction using metal color indicators and solutions*
6. *Able to determine the concentration of a compound and accuracy in the use of a spectrophotometer*

TPF 61001	**BIOLOGY**	**3 CREDITS (2-1)**

The course covers living organization, classification in biology. Function and structure of plant and animal. Reproduction system, molecular biology. Biosphere. Organism and environment. Role of biology in agriculture, industry and natural resources, environmental impact of assessment (EIA). Conservation and construction. Basic ecology. Energy flow and material cycles. The response of ecosystems to environmental technology and environmental adaptation tolerance law.

Course Learning Outcomes (CLO):

1. *Able to explain the definition of biology and its relationship with other sciences*
2. *Able to explain the organic materials that make up organisms*
3. *Able to explain cells and microorganisms divide and multiply*
4. *Able to explain the structure and function of plants in agricultural technology*
5. *Able to explain definition and benefits of biotechnology in agricultural technology and the environment*

TPF 61002	PRACTICAL OF BIOLOGY	1 CREDIT (0-1)

This practicum course studies the use of microscopes and methods perform micrometer calibration, microorganism cell structure, plant tissue, animal tissue, respiration and photosynthesis, biodiversity in ecosystems waters, as well as the interaction of biotic components in an ecosystem.

Course Learning Outcomes (CLO):

1. *Able to demonstrate use of microscope*
2. *Able to analyze microorganism cell structure*
3. *Able to analyze environmental factors that influence the adaptation and evolution of organisms*

TPF 62008	ORGANIC CHEMISTRY	3 CREDITS (2-1)

The concept of chemical bonds (definition of chemical bonds, ionic, covalent coordinates, understanding of polarity, etc.). The reactions in organic molecules, isometric, and stereoisomers, groups of compounds based on functional groups, biomolecular compounds, and other natural compounds (alkanes, alkenes, alkenes, organic acids, esters, ether, etc.) along with an explanation of their respective structures.

Course Learning Outcomes (CLO):

1. *Able to formulate, demonstrate and demonstrate structure and reactions and reactivity of organic compounds*
2. *Able to explain and apply the relation of chemical reactions to the mechanism of damage and the shelf life of food / agricultural products*
3. *Able to analyze and present alkanes, alkenes, alkyne, alcohol, ether, aldehyde, ketones, carboxylic acids, esters, aromatic compounds, organic halogen compounds, stereochemistry, polymers. Reactions in organic molecules*

TPE 62025	HEAT TRANSFER	3 CREDITS (2-1)

Heat transfer is a basis for technical knowledge in the field of agricultural technology. Students can analyze one-dimensional conduction heat, analyze homogeneous bodies of flat walls and hollow cylinders, analyze convection heat transfer, and the coefficient of natural convection heat transfer on vertical walls, interferometer in convection natural. Prerequisite: TPE 61010

Course Learning Outcomes (CLO):

1. *Able to explain and discuss the definition of heat transfer and heat transfer mechanism*
2. *Able to formulate, demonstrate and demonstrate various types of heat transfer mechanisms by convection, conduction, and radiation on various types of media*
3. *Able to explain and apply heat transfer in Agroindustrial Engineering and Biosystem*
4. *Able to analyze and present heat transfer in various applications in Agroindustrial Engineering and Biosystem.*

TPE 62026	PRACTICAL OF HEAT TRANSFER	1 CREDIT (0-1)

This practicum aims to observe the transfer of heat energy in a material, to measure the thermal conductivity of the material. The use of double pipe heat exchangers is carried out in order to make the practitioner better able to understand the basic concepts of heat transfer. The concept of conductivity coefficient is studied in this lab. Prerequisites: TPE 61010

Course Learning Outcomes (CLO):

1. *Able to calculate, demonstrate, and conclude Heat conduction one-dimensional*
2. *Able to calculate, demonstrate, and conclude conduction two dual dimensions*
3. *Able to calculate and conclude Application of heat transfer in cold storage*
4. *Able to calculate and conclude Fin and Heat Exchanger*
5. *Able to calculate and conclude Transfer of Heat Change Phase*

TPE 62004	CALCULUS 1	2 CREDITS

		(2-0)

This course covers the basic theorems of calculus, area, and volume of rotating objects, transcendent functions: logarithms, exponents, and trigonometry, techniques, integration, Laplace transforms, principles of transformations and inversions, laws of linearity, transformations for derived functions, and integrals. Students should able to solve differential equations and integrals.

Prerequisite: TPE 61002

Course Learning Outcomes (CLO):

1. *Able to understand and calculate real and complex number problems*
2. *Able to understand and calculate matrix problems*
3. *Able to understand and calculate derivatives and integrals*
4. *Able to understand and calculate solutions of 1st order differential equations*

TPE 62019	APPLIED MATHEMATICS	3 CREDITS (2-1)

Mathematical formulation of the fact the technical and theoretical approaches applied in the field of TP. Evaluation of accuracy and theoretical approach to the facts on the ground. Method of forming some relevant mathematical models in the field of TP. Prerequisite: TPE 62004

Course Learning Outcomes (CLO):

1. *Able to explain the concept of a mathematical formulation*
2. *Able to explain, make diagrams, and calculate by applying mathematical formulations*
3. *Able to analyze and discuss facts with technical theoretical approaches*

TPE 62007	COMPUTER APPLICATION	2 CREDITS (1-1)

Discussing computer hardware and software. Computer programming language Java and Visual Basic. The application of computers for statistical analysis, graphing, tabulation, and scientific writing by using some programming package for the problems in Agroindustrial Engineering and Biosystem.

Course Learning Outcomes (CLO):

1. *Able to explain the basic computer hardware and software concepts*
2. *Able to explain and make simple algorithm schemes using flow charts*
3. *Able to explain and create simple application and/or database programs*
4. *Able to know and explain IC3 test.*

TPE 62008	PRACTICAL OF COMPUTER APPLICATION	1 CREDIT (0-1)

Practicum is designed to explain the basics of programming language and coding. A detailed introduction to the function of each code. And applied directly for making simple applications using the functions that have been described.

Course Learning Outcomes (CLO):

1. *Able to demonstrate IDE Software Basic programming and coding*
2. *Able to demonstrate tool boxes and creating simple applications*
3. *Able to demonstrate event procedures control program functions*
4. *Able to demonstrate Database programming 1*
5. *Able to demonstrate Database programming 2*

TPE 62024	AGRICULTURAL MATERIAL SCIENCE	2 CREDITS (2-0)

Provide knowledge of food commodities of vegetable origin (plant products) and animal (and fishery products). The contents can include the following aspects: source varieties / races, the chemical composition and structure of the network, postharvest physiology / post-mortem. Factors affecting the activity of tissue and cell changes permanent, damage chemically, physically and their effects on agricultural output. Treatment of cooling, freezing, controlled atmosphere storage on the quality of agricultural products.

Course Learning Outcomes (CLO):

1. *Able to understand and explain the importance of understanding the physicochemical properties of agricultural materials for designing agricultural processing tools and processes*
2. *Able to understand and explain the physicochemical properties of cereal, plantation, and horticultural products*
3. *Able to understand and explain the physicochemical properties of*

animal products such as poultry, fish, meat, and bees.

TPE 61014	TECHNICAL DRAWING	3 CREDITS (2-1)

History, purpose, and technical drawing equipment. Normalized size drawing paper. Normalization of letters and numbers. Various lines. Geometry techniques. Penunjujan size. Image projection systems and sketches. Cross-sectional images and a variety of shading. Screw, springs, and gears.

Course Learning Outcomes (CLO):

1. *Able to apply the principles of drawing techniques according to ISO standards manually and use CAD*
2. *Able to draw machine elements by applying the principles of technical drawing according to ISO standards manually and using CAD*
3. *Able to draw product designs in the field of agricultural and agro-industrial engineering or agribusiness by applying the principles of technical drawing according to ISO standards*

TPE 61015	PRACTICAL OF TECHNICAL DRAWING	1 CREDIT (0-1)

Practicum learns the basics of drawing techniques using the auto-cad application. An understanding of the function of tools in the application to form objects. Application and application of tool functions are applied to create an agricultural object that will be displayed at a technical drawing exhibition.

Course Learning Outcomes (CLO):

1. *Able to demonstrate CAD and Assignment 1*
2. *Able to demonstrate AutoCAD basics and 2D drawing practice: AutoCAD menu and toolbar, 2D drawing exercises*
3. *Able to demonstrate Assignment 2: draw 2D*
4. *Able to Practice rendering and 3D drawing: windmills*
5. *Able to demonstrate Assignment 3: draw 3D*

TPE 61011	STATISTICS AND DYNAMICS	3 CREDITS (2-1)

Definition of vectors, vector operations, analysis of coplanar parallel force, non-parallel and non-concurrent, coplanar resultant force, moment of a coplanar force. Understanding the spatial force systems, operating systems concurrent spatial force, parallel, non-concurrent and non- parallel, moments of a spatial force system. Determination of equilibrium, force balance, the balance of the moment, the application of concurrent and non- parallel systems, the analysis of the balance point by point, determination of the amount and type of force that occurs in an individual girders, balance concurrent systems, parallel, non-concurrent and non-parallel.

The general concept of the first moments, the centroid for a single object and the composition, extent and mass moment of inertia, the mechanical properties of the cross section . Girders and cables, the general concept of kinematics, trajectory, velocity, acceleration. Motion in a straight line and in curve. Constant acceleration and not constant acceleration, the general concept of kinetics, Newton 's Law I, II and III. Vector equation of a scalar equation of the shifting movement, work, power, efficiency, kinetic energy from the movement of a solid object, the kinetic energy of a solid object in a state of spin.

Course Learning Outcomes (CLO):

1. *Able to explain basic concepts of statics and dynamics.*
2. *Able to explain, make diagrams, and calculate by applying the basic theory of statics and dynamics.*
3. *Able to explain, discuss, and evaluate problems of statics and dynamics.*

TPE 61012	FLUID MECHANICS	3 CREDITS (2-1)

Basic concepts, fluid properties, and dimensional analysis of the equations of fluid. Analysis and similitude dimensions, fluid statics, fluid dynamics, and fundamentals of flow in the pipe (closed) ideal fluid, both steady flow and incompressible and compressible, the fundamentals of *open channel flow both uniform and non-uniform flow. Analysis of head loss or energy flows, including minor losses in the closed and open, and the pump power requirements and power generation liquid fluid. The basics of the theory and application of a variety of fluid flow measurement.*

Course Learning Outcomes (CLO):

1. *Able to explain the definition, scope and benefits of fluid*
2. *Able to explain fluid statics based on pressure on fluid and buoyancy*
3. *Able to explain and calculate fluid flow in one, two and three dimensions*
4. *Able to explain and calculates the flow rate of discharge and the flow coefficient through the hole*
5. *Able to explain and calculate pipeline drain and its problems in agriculture*

TPE 61013	PRACTICAL OF FLUID MECHANICS	1 CREDIT (0-1)

Explains the basics of fluids. Proof of the buoyancy theory. Calculation of the friction force of water against the pipe in its path. Understand the bulkhead / limit for fluid flow to calculate the amount of discharge that can occur.

Course Learning Outcomes (CLO):

1. *Able to demonstrate and calculate fluid statics based on pressure on fluid and buoyancy*
2. *Able to demonstrate and calculates the flow rate of discharge and the flow coefficient through the hole*
3. *Able to describe and calculate flow through open channels, pipeline drain and its problems in agriculture*

TPE 61010	THERMODYNAMICS	3 CREDITS (2-1)

The basic concepts of thermodynamics, energy forms, systems, processes, and thermodynamic cycle, the system unit, pressure and temperature, properties of pure substances and characteristics of an ideal gas, the first law of thermodynamics in a closed system, includes heat, work, specific heat, energy, enthalpy and specific heat of an ideal gas, the Laws of

Thermodynamics I open system (volume control), the second law, the reservoir of heat energy (thermal energy reservoirs), heat engines (heat engines), engine cooling and heat pump, (refrigerators and heat pumps), a perpetual motion machine (perpetual-motion-machines), Carnot cycle, Carnot's principle, Carnot heat engine, refrigeration and heat pump Carnot. Prerequisites: TPE61002, TPE61003, TPF61006 ***Course Learning Outcomes (CLO):*** 1. *Able to explain the basic concepts of thermodynamics, understand the Law of Thermodynamics and the system of thermodynamics* 2. *Able to understand and explain reversible and irreversible processes* 3. *Able to understand the position and determination of the working fluid in the p-v or T-s field and be able to read the physical properties table* 4. *Able to analyze various kinds of thermodynamic cycles* 5. *Able to apply thermodynamics of unreacted mixtures* 6. *Able to apply the Psychrometry concept to the process of decreasing and increasing RH, AC, and Cooling Towers* **7.** *Able to apply thermodynamic principles in technological innovation and calculate the effectiveness and efficiency of products*

TPF 60011	**ENGINEERING ECONOMICS**	**3 CREDITS (3-0)**
This course contains the definition and use of the techniques of economic analysis, equivalence, equivalence an alternative, alternative selection, analysis of capital controls, depreciation, taxes, economic age, the use of cost analysis, analysis of point return and minimum cost analysis, sensitivity analysis of inflation and principal. The relationship between the time value of money and the interest rate of capital. Cost analysis tools and agricultural machinery, production analysis. Analysis of alternative methods of B / C, Break-Even Point (BEP), the evaluation of agricultural projects. ***Course Learning Outcomes (CLO):*** 1. *Able to apply calculations using the interest formula, cost concept, annual and present value equivalents, ROR, depreciation, tax, inflation, BCR, BEP, sensitivity analysis, and other technical analysis in solving agricultural technology problems* 2. *Able to interpret engineering economics in business and project*		

evaluation in the field of agricultural technology

TPE 61033	BUSINESS MANAGEMENT	2 CREDITS (2-0)
Basic theory of demand-supply. Basic management. Concept of Business Strategy; Stages In Business Strategy Systems company; Business Environment; Business Strategy Formulation; Analysis of Business Strategy; Strategic Alliance; Corporate Business Strategy; Business Competence Strategy; Strategy and Technology Management; Strategy and Management of R & D. Building a Strong Brand and Brand Strategies for Maximizing Value; Pricing Strategy; Sales Management; Mix Communications; Customer Relationship Management (CRM); Role of CRM in Improving Customer Service Quality. ***Course Learning Outcomes (CLO):*** *1. Able to understand creative and innovative thinking processes in the field of agricultural engineering.* *2. Able to provide ideas and ideas related to business management based on agricultural engineering science.*		

TPE 61055	IRRIGATION AND DRAINAGE	3 CREDITS (2-1)
Definitions, land leveling for irrigation, water measurement, irrigation water requirements, irrigation scheduling, irrigation efficiency, water distribution channel is open, channeling water to a closed channel, irrigation water quality, irrigation systems, understanding drainage for agriculture, drainage and water movement and system drainage. Plant responses to changes in soil water and its correlation to the provision of nutrients. Adsorption of water by root systems and processes on plant physiology. Water stress in plants. ***Course Learning Outcomes (CLO):*** *1. Able to explain water sources in nature and the development of irrigation and drainage* *2. Able to describes the primary, secondary and tertiary sewer system* *3. Able to explain drip irrigation, bulk irrigation and planning* *4. Able to analyze regarding the drainage system and groundwater*		

flow

TPE 61056	**PRACTICAL OF IRRIGATION AND DRAINAGE**	**1 CREDIT (0-1)**

Practicum is designed to study irrigation and drainage systems. The basic concept of flow rate is suitable to determine the amount needed in the world of agriculture. Experiment on water infiltration rate. The use and concept of types of drip irrigation and testing of water quality.

Course Learning Outcomes (CLO):

1. *Able to calculating and determining the water requirements needed for irrigation*
2. *Able to practicing how to schedule irrigation water for crops*
3. *Able to calculate and demonstrate irrigation efficiency and efforts to achieve efficiency*

TPE 62027	**POWER IN AGRICULTURE 1**	**3 CREDITS (2-1)**

Classification of resources (energy of motion) in agriculture, including the historical development of motor fuel. Application of principles of thermodynamics of combustion engine. The design, construction, and working system functional parts on either diesel motor fuel or gasoline. Evaluation of the performance of motor fuel.

Prerequisite: TPE 61010

Course Learning Outcomes (CLO):

1. *Able to explain the working principles of the generation, transmission and utilization of power in agriculture*
2. *Able to explain, diagram, calculate, and measure internal combustion motor performance*
3. *Able to explain, diagram, calculate, and measure the performance of agricultural tractors*

TPE 62028	**PRACTICAL OF POWER IN AGRICULTURE 1**	**1 CREDITS (0-1)**

Power Practicum in Agriculture aims as a basic introduction to the components, functions, principles and working mechanisms of 2-wheel tractors and 4-wheel tractors. Then also about understanding the internal combustion system in the combustion motor and lubrication on the engine. Prerequisite: TPE 61010

Course Learning Outcomes (CLO):

1. *Able to observe, demonstrate, and conclude piston movement in the cylinder combustion motor*
2. *Able to observe, demonstrate, and conclude carburizing principle*
3. *Able to observe, demonstrate, and conclude constituent Cooling and Lubrication Systems*
4. *Able to demonstrate 4 and 2 Wheeled Agricultural Tractors*

TPF 60010	**STATISTICS**	**3 CREDITS (2-1)**

The course introduces about application of statistics. Simplification of data, size differentiation, and dissemination of data, and presentation of the line equation in the table. Frequency list, histogram, and branches of leaves, box diagrams, beamlines, and dots. Modeling by probability and distribution function. Discussion about the population and sample. Parameter estimation and hypothesis testing. Methods of data collection, surveys, and problems. Analysis of variance for comparison of median values. Linear regression with two variables. Contingency table analysis and factorial design.

Course Learning Outcomes (CLO):

1. *Able to explain the notion of statistics, population, and samples as scientific disciplines and their application in life*
2. *Able to explain the meaning of the frequency distribution, class intervals and class boundaries and calculate the frequency distribution of the data*
3. *Able to create and interpret graphs to describe categorical variables*
4. *Able to formulate null and alternative hypotheses for application to means of normal distributions and proportions (large sample)*
5. *Able to interpret simple linear regression of the data set*

TPE 61038	**AGRICULTURAL ELECTRICITY AND ENERGY**	**3 CREDITS (2-1)**

This course covers: 1. A description of alternative energy sources, 2. Energy biomass, 3. Energy of wind, 4. Energy of water, 5. Energy of the sun, 6. Process of energy conversion, 7. Machine conversions, 8. Transformer, 9. Circuit system 10. Theory of combustion diagram to audit value.

Course Learning Outcomes (CLO):

1. *Able to explain various sources of energy, basic energy theory, transformer basic theory, and combustion theory.*
2. *Able to explain and analyze the energy conversion process, conversion engine components, and combustion circuit systems.*

TPE 61039	PRACTICAL OF AGRICULTURAL ELECTRICITY AND ENERGY	1 CREDIT (0-1)

Introduction to the solar panel system, the efficiency obtained from the energy converted using solar panels. Discusses the concept of energy conversion that often occurs in everyday life. The manufacture of biodiesel using cocoa oil is carried out in this lab.

Course Learning Outcomes (CLO):

1. *Able to analyze and conclude energy efficiency of solar cells*
2. *Able to analyze and conclude concept of energy conversion efficiency*
3. *Able to analyze and conclude solar cells (Photovoltaic)*
4. *Able to analyze, demonstrate and conclude process of making biodiesel*

TPE 62020	STRENGTH OF MATERIALS	3 CREDITS (2-1)

Provide the knowledge on the strength of materials related to load and strength of agricultural machine/tool elements. Basic concepts and calculation of stress include normal, shear, torsi stress, stress at thin wall vessel, in-determined stress, moment, torsi, deflection, and join. Prerequisite: TPE 61011

Course Learning Outcomes (CLO):

1. *Able to calculate and explain the mechanical properties of materials and make and read diagrams*
2. *Able to calculate stress-strain and – displacement (displacement) in the structure of rods, shafts, beams, and columns*
3. *Able to calculate main stress (axial stress and circumference stress) acting on pressure vessel, able to calculate and select pressure vessel thickness*
4. *Able to calculate, construct, and describe shear force diagrams and bending moment diagrams in beams and beam deflections using the moment area method and multiple integration.*

TPE 62021	**PRACTICAL OF STRENGTH OF MATERIALS**	**1 CREDIT (0-1)**

This practicum is designed to enable the practitioner to understand the concept of testing the strength of a material. By applying several methods for testing. Use of Universal Machine Testing (UTM) measuring tensile strength, resistance strength, and bending. UTM also shows the amount of load a material can accept, the elastic limit and so on. The testing method using the Brazilian Test is also carried out in this lab. Prerequisite: TPE 61011.

Course Learning Outcomes (CLO):

1. *Able to calculate, demonstrate and conclude Tensile test practice*
2. *Able to calculate, demonstrate and conclude deflection with the area-wide and double integration method*
3. *Able to calculate, demonstrate and conclude building strength*

<table>
<tr><td>TPE 62022</td><td>CONTROL SYSTEM</td><td>3 CREDITS (2-1)</td></tr>
<tr><td colspan="3">The course includes a control system subject as follows: 1. Introduction of control systems, 2. Mathematical models of dynamic systems, 3. Actions basic controls and automatic industrial controller, 4. Transient response analysis and error analysis, 5. Analysis and design of control systems with conventional methods, 6. Analysis of the location and root, 7. response analysis and frequency, 8. compensation technique and design, 9. pointer analysis function of the non-linear control system, 10. Analysis of control systems in position space, 11. Designing control systems with of position space method.
Prerequisite: TPE61016, TPE61017
Course Learning Outcomes (CLO):
1. Able to explain, diagram, calculate models of mathematical
2. Able to explain, and calculate dynamic system response
3. Able to design and analyze a control system for bioreactor cases
4. Able to explain various kinds of up to date concepts of modern bioprocess control systems</td></tr>
<tr><td>TPE 62023</td><td>PRACTICAL OF CONTROL SYSTEM</td><td>1 CREDIT (0-1)</td></tr>
<tr><td colspan="3">This practicum is conducted as an introduction to simple coding on Arduino Uno, LCD settings, servo motors, and LM35. Prerequisite: TPE61016, TPE61017
Course Learning Outcomes (CLO):
1. Able to demonstrate and conclude microcontrollers, Arduino, and basic programming of LEDs
2. Able to calculate demonstrate and conclude Programming sensor reading and display presentation
3. Able to calculate demonstrate and conclude Servo motor actuator control
4. Able to demonstrate and conclude ON-OFF and PID controllers
5. Able to demonstrate and conclude PLCs</td></tr>
<tr><td>TPE 61031</td><td>WORKSHOP ENGINEERING</td><td>3 CREDITS (2-1)</td></tr>
</table>

The concept of workmanship and postharvest system workshop management, welding techniques including automatic welding and arc welding, welding of several types of metal, safety and fastening tools, fastening of tool and machine components including rivets, bolts, nuts, pegs, screws, capable nails. Measuring work, hand working, primary forming process, cutting and drilling, grinding and milling, assembly method and workshop layout ***Course Learning Outcomes (CLO):*** 1. *Able to explain the physical, mechanical, hardness and strength of materials in workshops* 2. *Able to explain the process of working with hands in workshop* 3. *Able to explain hot and cold working techniques* 4. *Able to explain the welding of several types of metal and welding techniques, as well as to analyze joining and cutting techniques using gas welding* 5. *Able to explain assembly methods and finishing processes* **6.** *Able to determine the concept, management, and production process of the workshop work tools*

TPE 61032	**PRACTICAL WORKSHOP ENGINEERING**	**1 CREDIT (0-1)**
Practicum is designed as an implementation of the field science that has been learned in designing a tool or machine, such as how to use welding, hand grinding, seated grinding, etc. In addition to the process of making tools, this practicum is also integrated with the engineering design that has been studied. ***Course Learning Outcomes (CLO):*** **1.** *Able to demonstrate Measurement and hand work* **2.** *Able to demonstrate Hot and cold working* **3.** *Able to demonstrate Gas welding technique (autogen)* **4.** *Able to demonstrate Grinding and Milling* **5.** *Able to demonstrate Assembly method* **6.** *Able to design Workshop layout*		
TPF 61014	**RESEARCH METHOD AND SEMINAR**	**2 CREDITS (2-0)**

In this subject, the ways of doing scientific research, including the determination of the problem, identifying research variables can design experiments and experiment with various types of experimental design such as RAL, RAK, Factorial, nested and Shuffle able to test the experiment with non-parametric (Friedman test, Wilson and different test: t test, LSD and DMRT) and non-experimental design, observation and data collection, interpretation of results of analysis experiments.

Course Learning Outcomes (CLO):

1. *Able to recognize, know and understand the structure of scientific knowledge*
2. *Able to know, know and understand about various methods and types of research*
3. *Able to know and understand about experimental and pre-experimental designs*
4. *Able to know and understand about research steps*
5. *Able to know and understand and explain the role of statistics in research*
6. *Able to compile scientific reports*

TPE 61037	**MACHINE ELEMENT DESIGN**	**2 CREDITS (2-0)**

Simple forces and stress on machine element. Basic design on shaft keys, b support. Pre-requisite: TPE 62020

Course Learning Outcomes (CLO):

1. *Able to explain a concept or design principle*
2. *Able to calculate, predict, and plan shafts with punter loads, shafts with pure bending loads, shafts with punter and bending loads, slide bearings, transmission belts, chain rollers, gears and springs.*
3. *Able to analyze the forces on the connection system and determine the appropriate bolt / rivet specifications, make frames and be able to calculate the required weld thickness.*

TPE 61040	**FARM BUILDING**	**2 CREDITS (2-0)**

The definition and scope of farm buildings. Environment and development. Measurement applications in buildings. Functional design of the building. Structural design of buildings.

Course Learning Outcomes (CLO):

1. *Able to explain building types, calculate the load that is supported by members of the building structure, the requirements for the structural requirements of agricultural building members.*
2. *Able to explain building types, calculate the load that is supported by members of the building structure, the requirements for the structural requirements of agricultural building members.*
3. *Able to explain the type of soil for the building site, select the soil layer for the building site, the carrying capacity of the soil, the hydraulic conductivity of the soil, the investigation of soil strength, soil analysis, calculate the bearing capacity of several types of foundation.*
4. *Able to explain the foundation, its function and planning, the factors that need to be considered in making a foundation, the type of foundation, the classification of the foundation, the failure mechanism.*

TPE 62046	LAND SURVEYING AND MAPPING	3 CREDITS (2-1)

The scope of regional measuring science in Agroindustrial Engineering and Biosystem is able to use simple measuring instruments that include editing, BTM, and theodolite. Capable of measuring height differences, making situation maps, topography, editing, measuring profiles, and drawing.

Course Learning Outcomes (CLO):

1. *Able to know the behavior of measuring instruments; draw a map from the calculated data using simple drawing tools and computers; and draw a contour map from a location whose contour shape is not yet known using various alignment methods.*
2. *Able to explain the mapping stages; calculate the measurement results; interpret maps for planning; calculate area and volume area from contour data; understand the function and role of topographic maps for area analysis; and understand the topographic situation of an area.*
3. *Able to take measurements using binocular-based measuring tools and determine regional height differences through mapping using a mapping tool.*
4. *Able to evaluate the results of profile measurements to determine whether the measurement results are acceptable or not*

TPE 62047	PRACTICAL LAND SURVEYING AND MAPPING	1 CREDIT (0-1)

Use of simple measuring instruments, cutters, BTM, and Theodolite. Measuring altitude differences, creating situation maps, topography, editing, profiling and drawing. Map interpretation.

Course Learning Outcomes (CLO):

1. *Able to calculate, demonstrate, and conclude about Leveling*
2. *Able to calculate, demonstrate, and conclude about Profile*
3. *Able to calculate, demonstrate, and conclude using the mapping tools*

TPE 62048	SYSTEMS ENGINEERING	2 CREDITS (2-0)

Have the ability to use engineering principles to design technological products. Able to work in groups professionally and innovatively of effective scientific communication skills. Have expertise in identifying, formulating, analyzing, and solving Agroindustrial Engineering and Biosystem problems through a systems approach. Have expertise in exploring and developing science and technology in the field of Agroindustrial Engineering and Biosystem. Have expertise in the development of entrepreneurship.

Course Learning Outcomes (CLO):

1. *Able to explain the system's scope related to requirements, methodology, life cycle, and system modeling that support system analysis and system simulation.*
2. *Able to apply dynamic program modeling techniques and inventory models, and monte carlo simulations on queuing systems and use system control techniques*

TPE 62043	OPERATIONAL RESEARCH	2 CREDITS (2-0)

Solving problems to optimize the use of limited resource availability with linear programming (linear programming) using the simplex method and its application in a particular form: the transportation problem, the assignment (and time division multiple), and transshipment.

Course Learning Outcomes (CLO):

1. *Able to understand basic concepts in Operations Research and methods used for problem-solving*
2. *Able to apply methods of determining objective functions, decision variables, and limiting functions to formulate a problem in linear form in a case example*
3. *Able to solve optimization problems through Linear Programming methods (graph method, Simplex table, VAM-NWCR transportation method, Stepping Stone, MODI, queuing theory, and transshipment model)*
4. *Able to evaluate optimization results with linear programming and its application in case studies in the agribusiness and agroindustry fields*

TPE 61034	FOOD PROCESSING TECHNIQUE & AGRICULTURAL PRODUCTS	3 CREDITS (2-1)

Processing technique since harvesting until become processed product. This process includes cleaning, drying, shelling, material handling, milling, size reduction. Food processing includes basic rheology, heating and cooling. Prerequisite: TPE62025, TPE62026.

Course Learning Outcomes (CLO):

1. *Able to identify, formulate, analyze and solve problems during drying, freezing, freezing, storage, packaging, thermal and non-thermal processes in agricultural engineering through a systems approach*
2. *Able to explain creative and innovative thinking to improve working ability using food engineering principles such as drying, cooling, freezing, storage, packaging, thermal and non-thermal processing consistently following professional ethics.*
3. *Able to use, manage, utilize and apply food engineering principles in designing product technology related to agricultural engineering, especially agricultural products for the development of food processing products.*

TPE 61035	PRATICAL OF FOOD PROCESSING TECHNIQUE & AGRICULTURAL PRODUCTS	1 CREDIT (0-1)

This practicum includes the use of vaccum frying to extend shelf life. The storage effect test uses plastics that have different density values to see the final physical properties of agricultural materials. Testing of drying techniques to increase shelf life. As well as the use of a pasteurization system to deactivate bacteria in milk. Prerequisites: TPE62025, TPE62026.

Course Learning Outcomes (CLO):

1. *Able to calculate, demonstrate, and conclude Pasteurization practice*
2. *Able to calculate, demonstrate, and conclude Packaging and storage practices*
3. *Able to calculate, demonstrate, and conclude drying practice*
4. *Able to calculate, demonstrate, and conclude Vacuum frying practice (vacuum frying machine)*

TPE 61036	NUMERIC METHODS	2 CREDITS (2-0)

This course covers the subject of: 1. Difference of analytic methods and numerical methods, 2. Theory calculation error, 3. Roots equations and non-linear equations, 4. Matrix and linear equations, 5. Interpolation, 6. Numerical Differential, 7. Integral Numerical, 8. Settlement for the numerical solution of differential and integral equations. 9. Completion of partial differential equations.

Prerequisite: TPE 62004.

Course Learning Outcomes (CLO):

1. *Able to explain the fundamental difference between Numerical solving and analytic solving*
2. *Able to explain, solve mathematical problems using numerical methods*
3. *Able to apply and discuss the use of numerical methods in bioprocess problems*
4. *Able to evaluate the advantages and disadvantages of using the numerical method*

TPE 61049	POST-HARVEST TECHNOLOGY	2 CREDITS (2-0)

The basic concept of packing, storage, drying and cooling technique. The basic concept in the theory and practice of packaging materials storage of agricultural produce. Determinant of the quality elements of storage (dry and cold). The nature of the properties of water vapor in the atmospheric air heating / cooling (Psikrometrik and Mollier diagram). Drying and cooling components in the energy and mass balance. Effect of cooling on agricultural products (fresh produce, processed products). Damage caused by the cooling of the fresh products (fruits).

Course Learning Outcomes (CLO):

1. *Able to explain the basic concepts of TPPP which include the scope of TPPP, post-harvest physiology, Good Agriculture Practice, Good Manufacturing Practice.*
2. *Able to explain post-agricultural product handling procedures along with the necessary equipment and working principles; able to work independently and in groups to identify a post-harvest handling case, select relevant basic theories, and be able to analyze the relationship between the basic theory and the real conditions of the case studies provided and provide development ideas.*
3. *Able to explain the principles of size reduction, count and explain the distribution of particles, as well as the types of tools needed and their working principles.*

TPE 61052	DYNAMICS OF MACHINE AND SOIL	3 CREDITS (2-1)

The course covers the dynamics of the engine and land the subject: 1. Changing the mechanical behavior of the soil. As a result of agricultural implements and wheeled vehicles in the process of tillage and traffic equipment. Include the stress, strain, deformation, compaction, failure (destruction), soil displacement, soil corrected power, and scarify process. 2. Influence of soil conditions on the performance of agricultural equipment and wheel. Include the amount of traction, the magnitude of the loading, the level of immersion wheels, skid magnitude, and fuel consumption. 3. Analysis on the use of agricultural machinery and tools relating to land.

Course Learning Outcomes (CLO):

1. Able to explain the concept of dynamics in machine and soil. 2. Able to explain, calculate, and measure by applying the theory of machine and soil calculations. 3. Able to explain and discuss problems related to machinery and soil.		

TPE 61053	**PRACTICAL OF DYNAMICS OF MACHINE AND SOIL**	**1 CREDIT (0-1)**
This practicum includes checking the physical properties of the soil using tools. The use of tools and discussion in this practicum can help the practitioner understand the treatment that must be done on agricultural land. As well as discussing the balance / center point of several tools for the ground. ***Course Learning Outcomes (CLO):*** *1. Able to calculate, demonstrate, and conclude strong Ground Shear* *2. Able to calculate, demonstrate, and conclude Soil Penetration Resistance* *3. Able to calculate, demonstrate, and conclude Load Center Point*		

TPL 62017	**EXPERIMENTAL DESIGN**	**2 CREDITS (2-0)**
The purpose and goal of the experimental design. Principles of experimental design. The sources of the experimental apparatus and techniques to overcome them. The design of the treatment. The environmental design. Problems in the management response experiments. Exemplary analysis for some raw draft. Analysis covariant. Assumptions underlying the analysis of variance model and conformance tests. ***Course Learning Outcomes (CLO):*** *1. Able to understand and explain the principles of experimental design, data collection and processing techniques in Agroindustrial Engineering and Biosystem* *2. Able to calculate, create, and describe analysis of variance* *3. Able to calculate and describe linear regression analysis*		

TPE 61041	**OPERATIONAL UNIT**	**2 CREDITS**

		(2-0)

Black box philosophy, basic concept of transfer mass, energy and momentum; mass, energy and momentum balances. The basic concept of several unit operations includes thermal process, mixing, crystallization, distillation, extraction. Prerequisite: TPE62025, TPE62026

Course Learning Outcomes (CLO):

1. *Able to understand basic concepts in Operations unit and methods used for problem solving*
2. *Able to apply methods of determining function objectives, decision variables, and limiting functions to formulate a problem in linear form in a case example*
3. *Able to solve optimization problems through Linear Programming methods (graph method, Simplex table, VAM-NWCR transportation method, Stepping Stone, MODI, queuing theory and transhipment model)*
4. *Able to evaluate optimization results with linear programming and its application in case studies in the field of agribusiness and agro-industry*

TPE 61054	**CULTIVATION MECHANIZATION OF PLANTATION CROP**	**2 CREDITS (2-0)**

Discussion subjects include Plantation Crops Mechanization case study on the culture of sugarcane mechanization either in paddy fields and in dryland / dry. Mechanization of oil palm cultivation ranging from land planning, early planting, maintenance, harvesting and mechanization of manufacturing process. Prerequisite: TPE 4234

Course Learning Outcomes (CLO):

1. *Able to explain mass transfer, Fick's law, mass balance in batch and continuous systems.*
2. *Ableto explain Newton's law for viscosity of Newtonian fluids with non-Newtonian fluids.*
3. *Able to determine and calculate rheological constants of viscous, bingham and non-bingham fluids, heat balance of drying.*
4. *Able to explain the basics of filtration, liquid-vapor balance of binary mixed distillation and Raoult's Law.*
5. *Able to explain the basic principles, work methods and objectives of the boiler system.*

TPE 62066	**BIOENERGY ENGINEERING**	**2 CREDITS (2-0)**

Bioenergy course aims to introduce some aspects of bioenergy. It includes introductory material and material bioenergy. Introduction consists of the national energy demand and energy supply, energy planning methodologies and human needs, information in energy planning, energy sources, and future energy needs. The bioenergy material consists of biomass energy source, biomass gain, direct biomass combustion, pyrolysis, fermentation alcohol, anaerobic digestion, biogas technology, and biogas family planning, community planning, and institutions biogas, biodiesel technology.

Course Learning Outcomes (CLO):

1. *Able to explain various aspects of sources of energy needs and planning methodologies for processing alternative energy for future needs.*
2. *Able to classify alternative energy according to its properties to be converted into various forms of energy.*

TPE 61002	**BASIC MATHEMATICS**	**2 CREDITS (2-0)**

This course explain about functions, inverse functions, composition functions, quadratic functions, exponential functions, logarithmic functions, trigonometric functions, lines and series, limits, logical mathematics, Taylor series, Newton Rapson

Course Learning Outcomes (CLO):

1. *Able to understand and calculate mathematical function prob logarithmic and trigonometric)*
2. *Able to understand the concept of limits and calculate limit probler*
3. *Able to understand and calculate mathematical logic series probler*

TPE 61001	INTRODUCTION TO AGRICULTURAL TECHNOLOGY	2 CREDITS (2-0)

Students are able to explain the scope of Agricultural Technology, including agricultural product technology, Agroindustrial Engineering and Biosystem, and agricultural-industrial technology

Course Learning Outcomes (CLO):

1. *Able to recognize and understand the state of agriculture in Indonesia, agricultural mechanization, the objectives of agricultural mechanization, the coverage of agricultural mechanization fields, the application of agricultural mechanization and application barriers*
2. *Able to analyze source of energy in agriculture*
3. *Able to recognize, know and understand about the factors that affect the harvesting process and how to harvest*
4. *Able to know and understand about agricultural raw materials*
5. *Able to explain about the characteristics of rice and drying machines,*
6. *Able to know and understand about seeds (grains), fruit and vegetables*
7. *Able to know and understand and explain the mechanization strategy towards modern agriculture*

TPE 61016	ENVIRONMENTAL MEASUREMENT	3 CREDITS (2-1)

This course contains passive and active components, analog electronics, semiconductor basics, diodes, transistors, ICs, OP-AMP, digital electronics, boolean algebra, logic gates, flip flops, decoder, and encoder, seven-segment display. Overview of modern instrumentation techniques and digital electronic components and subsystems for integrating them into digital data acquisition and environmental measurement and processes. Emphasis on the use of laboratory equipment. Topics include transducers, and digital acquisitions.

Course Learning Outcomes (CLO): 1. *Able to explain the working concept of basic electronic components* 2. *Able to explain, diagram, calculate, assemble, and measure by applying basic electronic theory* 3. *Able to explain, make diagrams, discuss parts of the instrumentation system* 4. *Able to explain, create schemes, arrange, evaluate instrumentation systems.*

TPE 61017	**PRACTICAL ENVIRONMENTAL MEASUREMENT**	**1 CREDIT (0-1)**
Describes the basic components of electronic components. The working principle of each component. As well as the basic concept of converting physical values into digital values using electronic components or by using formulas. This practicum also tries to use electronic components in their respective functions. ***Course Learning Outcomes (CLO):*** 1. *Able to calculate, explain, demonstrate, and conclude components, tools and measurements using a multimeter* 2. *Able to demonstrate op-amp use* 3. *Able to calculate, demonstrate, and conclude stringing digital counters* 4. *Able to calculate, demonstrate, and conclude temperature measurement tools* 5. *Able to calculate, demonstrate, and conclude digital light intensity measurement tools*		

TPE 61018	**CALCULUS 2**	**3 CREDITS (2-1)**
This lecture provides learning techniques for solving complex derivatives, such as derivatives for functions with two or more variables. The scope of other materials is multiple integrals that include triple integrals in cartesian, cylindrical, and spherical coordinates. The Laplace method is the third subject matter given in this course. *Prerequisite TPE 62004.*		

Course Learning Outcomes (CLO):

2. *Able to understand and calculate solutions of Order 2 differential equations*
3. *Able to understand and calculate solutions of High Order differential equations*
4. *Able to understand and calculate partial differential equation solutions*
5. *Able to understand basic laplace transform theory and apply laplape transform to solve differential equations*

TPE62024	**ENGINEERING MATERIAL SCIENCE**	**2 CREDITS (2-0)**

This course provides knowledge about engineering materials, which includes general knowledge of engineering materials, atomic structure and interatomic bonds, solid crystal structure, mechanical properties of metals, dislocation and strengthening mechanisms, failure, phase transformation in metals, metal alloys, ceramics, polymers, composites, corrosion, and degradation of the material.

Course Learning Outcomes (CLO):

1. *Able to explain characteristic materials engineering.*
2. *Able to explain and understand diagram of phases of materials engineering.*
3. *Able to formulate and demonstrate various types of strengthening mechanisms and phase changes in various types of technical materials.*

TPE 62029	**ERGONOMIC AND OCCUPATIONAL HEALTH AND SAFETY**	**2 CREDITS (2-0)**

This course has a subject covering the elements of K3. The basics of K3 safety. The aims and objectives of SMK3 / OHSAS 18001: 2007. SMK3 introduction and interpretation. SMK3 preparation method. Manage SMK3 performance in the workplace. Hazard identification and risk assessment. Implementation and certification of SMK3. The body's work system. The working system of the human mind. The human sensory system, the interaction of the human body with the environment. Body rhythm and work shift. Work design principles are based on the human body. Man-machine system. Handling of physical loads. Cognitive

aspects of ergonomics. Ergonomics checklist. Ergonomics applications in the hospitality sector, agribusiness, and industry. Cognitive work analysis. Work analysis approach. Bad design related to cognitive ergonomics. Kansei engineering and its applications. Emotional design. Mental workload measurement. Canoe method
Course Learning Outcomes (CLO): 1. *Able to understand the basics of ergonomics and K3 in agricultural technology* 2. *Able to understand and calculate machine and human work systems through a work analysis approach* 3. *Able to understand the principles of work design based on the human body* 4. *Able to identify types of hazard and understand the method of compilation of K3 management system* 5. *Able to work together in groups professionally (A2) and able to provide ideas related to ergonomics and K3 in agricultural technology*

TPE 62030	FOOD PHYSICAL PROPERTIES	2 CREDITS (2-0)
This course has the source, variety, structure and physiology of vegetable and animal products, application of momentum, transfer of heat and mass in food processing; cooling, freezing and controlled atmosphere storage capable of performing analysis of selected operating units used in food processing, extrusion, dehydration, heat processing ***Course Learning Outcomes (CLO):*** 1. *Able to understand and explain geometry, microstructural properties, thermal and aerohydrodynamic properties of food and agriculture* 2. *Able to understand and explain the electromagnetic properties of food and agricultural materials and use them for postharvest applications* **3.** *Able to understand and identify friction, mechanical damage, rheology and hygroscopicity of food and agriculture*		

TPF 60007	PERSONALITY DEVELOPMENT AND PROFESSIONAL ETHICS	2 CREDITS (2-0)

This course contains the definitions and definitions of ethics and morals, code of ethics, and professionalism. Implement a professional code of ethics in an institution (including student ethics, lecturer ethics, educational ethics, lecture ethics), material on intelligence, personality, communication, and empathy concerning professional ethics. This course also discusses the status of standardization of professions and professional organizations (national and international).
Course Learning Outcomes (CLO): *1. Able to understand the meaning and dynamics of personality and personal development and can obtain appropriate knowledge of the totality of themselves* *2. Able to explain the meaning of morals, ethics, morals, and their urgency in life* *3. Able to the impact of ethics / morals on all aspects of life* *4. Students can get to know themselves better and understand various kinds of self-motivation* **5.** *Able to prepare to enter the world of work*

UBU 60003	**AGRO-INDUSTRIAL ENTREPRENEURSHIP**	**3 CREDITS (2-1)**
This course studies the characteristics of successful entrepreneurship (building dreams and pursuing ideals, motivating yourself, solving problems and running a business), intrapersonal skills (communication, leadership, and entrepreneurial motivation), developing creativity and innovation in creating superior service products, entrepreneurial marketing (personal and corporate), as well as entrepreneurial management (financial management, evaluation and business development). ***Course Learning Outcomes (CLO):*** *1. Able to understand the concept of entrepreneurship and the challenges of entrepreneurship in the modern era* *2. Able to understand the character of successful entrepreneurship* *3. Able to understand the concepts and functions of leadership in entrepreneurship* *4. Able to understand the concepts and functions of communication in entrepreneurship* *5. Able to understand and understand the importance of motivation in entrepreneurship*		

6.	*Able to understand the concepts and functions of creativity and innovation in entrepreneurship*

TPF 60015	**PRACTICAL AGRO-INDUSTRIAL ENTREPRENEURSHIP**	**1 CREDIT (0-1)**
This practicum teaches starting a business with a business group. Starting from the process of idea formation, product production, marketing, business reporting. Creating products that are unique so they can last over time.		
Course Learning Outcomes (CLO):		
1. Able to apply the concept of lean startup in starting an entrepreneurial business		
2. Able to apply the concepts and functions of networking in entrepreneurship		
3. Able to apply the concepts and functions of business financial management in entrepreneurship		
4. Able to apply the concepts and functions of business marketing management in entrepreneurship		
5. Able to apply the concepts and functions of business management in entrepreneurship		

TPE 62042	**DESIGN OF AGRICULTURAL TOOLS AND MACHINERIES**	**3 CREDITS (2-1)**
This course explains the design and types of agricultural machinery and tools, design principles, and steps to design agricultural tools and machines. Design of a cooling machine and an explanation of the various kinds of cooling factors. The drying machine's design, the evaporator machine's design, the way the press machine works, the hydraulic machine, which includes the basic principles, the working fluid, the piston, the cylinder cover, the pipeline, and the hydraulic pump. Machine tools and pneumatic control systems, mechanical machinery, and mechanical machinery design and applications. Prerequisite: TPE 61037		
Course Learning Outcomes (CLO):		
1. Able to describe and explain the basic concepts of ideas in the design of agricultural tools and machines.		
2. Able to calculate, predict, and analyze the demand for agricultural machinery.		

TPE 62044	AGRICULTURAL CULTIVATION TOOLS AND MACHINERIES	3 CREDITS (2-1)

This course explains tillage tools and machines, secondary processing tools and machines, planting tools and machines, fertilization tools and machines, weed control tools and machines, grain, corn, cotton, and tuber harvesting tools and machines capable of measuring work capacity agricultural tools and machinery and the selection of agricultural tools and machinery. Prerequisite: TPE62027, TPE62028

Course Learning Outcomes (CLO):

1. *Able to explain the basic concept in using tools and agricultural cultivation machines.*
2. *Able to explain, calculate, and measure the efficiency and effectivity of tools and planting machine.*
3. *Able to explain, analyze, and identify kind of tools and planting machine.*

TPE 62045	PRACTICAL OF AGRICULTURAL CULTIVATION TOOLS AND MACHINERIES	1 CREDIT (0-1)

Practicum is designed to study the tools and machines used for agricultural cultivation. Includes identification of tillage, weed extraction. Besides studying technology in agriculture, such as the operation of seed tables, transplants, and tractors Prerequisite: TPE62027, TPE62028

Course Learning Outcomes (CLO):

1. *Able to explain, demonstrate, and conclude identification of tillage equipment*
2. *Able to calculate, demonstrate, and conclude Seed table and transplanter*
3. *Able to calculate, demonstrate, and conclude about sprayer*
4. *Able to demonstrate, and conclude identification of weed control tools*
5. *Able to demonstrate and conclude about tractor*

TPE 61057	PLANT DESIGN	3 CREDITS (3-0)

A plant's design in the agroindustry sector starts from site considerations, processing selection, production capacity, material construction and material selection, multiple-scale experiments, flow diagrams, mass and energy utility balances, and hygienic manufacturing, piping systems, WWTP, and case studies. Agro-industrial unit design.

Course Learning Outcomes (CLO):

1. *Able to design a processing system*
2. *Able to analyze capacity requirements, machines, utilities, mass and energy balances in plant design in the agroindustry sector*
3. *Able to create a factory in the agro-industrial sector starting from location considerations, processing selection, determining production capacity, material construction and material selection, multiple-scale experiments, drawing flow diagrams, mass and energy balances, utilities, manufacturing hygienic, piping systems, WWTP*

TPE 61050	SOIL AND WATER CONSERVATION	3 CREDITS (2-1)

The course about soil and water preservation, the principles of water and wind erosion, erosion prevention methods, erosion control structures, embankments and reservoirs, flood and sedimentation control

Course Learning Outcomes (CLO):

1. *Able to explain the scope of soil and water conservation.*
2. *Able to calculate and complete analysis of rain data for its users.*
3. *Able to know the principles of soil and water conservation in agricultural engineering midwives.*

TPE 61051	PRACTICAL OF SOIL AND WATER CONSERVATION	1 CREDIT (0-1)

Learn the basic concepts of soil and water conservation. Observing the slope of the land in order to apply a method that is suitable for the land, as well as taking soil samples to simulate erosion that occurs in the soil. Erosion control structures are described as response measures to avoid erosion or to minimize its likelihood.

Course Learning Outcomes (CLO):

6. *Able to explain and conclude the basic concepts of soil and water conservation.*
7. *Able to observing the slope of the land in order to apply a method*

TPE 62058	ROBOTICS IN BIO-SYSTEM	3 CREDITS (2-1)

This course explains the basics of developing bio-production robots; robot components; manipulators, end-effectors, sensors, traveling devices, control devices, and actuators. Image acquisition; robots in bio-production in controlled environments; robots for open-area bio-production; robots in the food industry. Prerequisite: TPE 62022, TPE 62023/ TPO 62017, TPO 62018

Course Learning Outcomes (CLO):

1. *Able to explain the basics of bioproduction robot development.*
2. *Able to explain the components and functions of the manipulator, end-effector, sensor, traveling device, control.*
3. *Able to apply image acquisition robotics and algorithms in bioproduction or the food industry.*

TPE 62059	PRACTICAL ROBOTICS IN BIO-SYSTEM	1 CREDIT (0-1)

Practicum is designed to study electronics and instrumentation and introduction of resistors as electronic components. Identification of the parts of the instrumentation system (Sensing element, signal conditioning element, signal processing element, and display) and design into a robot agrobiosystem

Prerequisite: TPE 62022, TPE 62023/ TPO 62017, TPO 62018

Course Learning Outcomes (CLO):

1. *Able to explain and conclude electrical circuits related to resistors, and the introduction of other passive electronic components*
2. *Able to calculate, demonstrate, and conclude Digital electronic components (decoder, encoder, and 7 segments)*
3. *Able to calculate, demonstrate, and conclude the parts of the instrumentation system (Sensing element, signal conditioning*

	element, signal processing element, and display)
4.	*Able to calculate, demonstrate, and conclude data acquisition system and data logger*
5.	*Able to calculate, demonstrate, and conclude capita selecta instrumentation system related to agricultural engineering*

TPE 62060	PUMPS AND COMPRESSORS	2 CREDITS (2-0)
This course contains the definition and classification of pumps, basic design, basic pump theory, specific speed, efficiency, performance curves and cavitation, capable of designing angles and pump housings, testing, construction, pump installation in irrigation systems, and cost calculations.		
Course Learning Outcomes (CLO): *1. Able to explain the different types of pumps* *2. Able to explain the basic basics of pump fluid* *3. Able to describe how the pump works* *4. Able to perform pump functional tests* *5. Able to apply of the use of pumps in irrigation*		

TPE 60061	DRYING AND COOLING TECHNIQUES	2 CREDITS (2-0)
This course discusses an introduction in general to the process and application of drying and cooling in agriculture. Method of measuring moisture content, equilibrium moisture content, psychrometric chart. Examples of psychometric charts on drying, type of dryer by product and airflow. Natural and artificial cooling. Know the various refrigerators. The working principle of the refrigerator. The refrigerant (coolant) cycle. Calculation of heat and efficiency of the cooling engine. Application of Cooling techniques for postharvest and air conditioning. The cooling process and its effects on agricultural products (fresh products, processed products). Chilling damage to fresh produce (fruits). Freezing process. Estimated rate of freezing. Prerequisite: TPE 4145		

Course Learning Outcomes (CLO): *1. Able to understand and explain thermodynamic concepts in drying and vapor compression cooling systems* *2. Able to explain drying phenomena and vapor compression refrigeration cycles* ***3.** Able to simulate heat transfer in fluids*

TPE 62062	**RELATIONSHIP OF SOIL, WATER, AND PLANT**	**2 CREDITS (2-0)**
This course explains soil as a medium for growing plants that need water, providing nutrients, the relationship between soil and plants, water adsorption by roots and its processes in plant physiological systems, water stress in plants, the relationship between soil and plants ***Course Learning Outcomes (CLO):*** *1. Able to understand the basics of water, land and plant relations.* *2. Able to identify the types of relationships that occur in water, land and plants.* *3. Able to understand and calculate using growth simulations.*		

TPE 62063	**MODELLING AND SIMULATION TECHNIQUE**	**2 CREDITS (2-0)**
Modeling and simulation engineering courses cover the discussion of building a system of equations in the form of mathematical equations that are derived based on the basic laws that apply or occur in a system. The modeling approach is carried out with two approaches, namely the macroscopic approach and the microscopic approach. The results of a modeling process are generally in the form of differential equations or linear and non-linear equations. The results of the completion of the model are then simulated in a computer program. Model validation is an important part of comparing the simulation results with the experiments' results under the same conditions. Prerequisite: TPE 61036 ***Course Learning Outcomes (CLO):*** *1. Able to describe the scope of Modeling and Simulation Techniques including the background, objectives and benefit* *2. Able to describe the process of completing a macroscopic model* *3. Able to explain the role of the Newton Raphson method for solving non-linear equations* *4. Able to explain the role of the Multiflier Langange method for solving*		

non-linear equations 5. *Able to describes solving the fluid flow model analytically and 1-dimensional heat transfer* 6. *Able to describe the process of completing a model with elements*

TPE 62065	POWER IN AGRICULTURE 2	3 CREDITS (2-1)
This course includes: the classification and function of the tractor as a power source or source of motion for businesses in agriculture, the power forwarding system from the motor to each power outlet on the tractor, namely the hydraulic system, drawbar, and power take-off (OTO). Measurement and evaluation of tractor drawbar performance. Traction mechanics, tractor stability, and towing. Prerequisite: TPE62027, TPE62028 ***Course Learning Outcomes (CLO):*** 1. *Able able explains, select, operate the motor fuel in agriculture for performance.* 2. *Able to explain the working principle of the combustion motor and the working principle of the tractor.* 3. *Able to explain, make graphic schemes , assemble, evaluate the performance of the combustion motor and tractor.*		

TPE 62065	PRACTICAL POWER IN AGRICULTURE 2	1 CREDIT (0-1)
Measurement and evaluation of tractor drawbar performance; traction mechanics; tractor stability; and coupling *Prerequisite: TPE62027, TPE6202* ***Course Learning Outcomes (CLO):*** 1. *Able to demonstrate, and conclude observing the movement of the piston in the cylinder of the gasoline motor step* 2. *Able to calculate, demonstrate, and conclude the performance of a stationary combustion motor* 3. *Able to explain, demonstrate, and conclude agricultural tractor*		

parts 6. *Able to explain, demonstrate, and conclude clutch and transmission* 7. *Able to explain, demonstrate, and conclude differential and PTO parts*

2) Bachelor of Bioprocess Engineering

Course Syllabus of Bioprocess Engineering Study Program

MPK60001	**EDUCATION OF ISLAMIC RELIGION**	**2 CREDITS (2-0)**
Al-Qur'an and Science. The origin of life, human, earth, and the universe. Human and Religion. Status and function of the human, objectives, and program of human life. The role of religion in human life, kinds of religion. A review of religion other than Islam. The Islamic Aqidah; The outlines of Islamic teaching. Understanding and urgency of Tauhid, the discussion about Arkanul Iman, faith benefits. The Islamic Syari'ah; Understanding the Islamic syari'ah, Islamic shari'ah sources, discussion about Arkanul Islam, mu'amalah. Akhlaq Al-Islam; Understanding morality, good moral and akhlaqul madsumumah. Capita Selecta; The history of Islam.		
Course Learning Outcomes (CLO): 1. *Able to understand and implement monotheism in life* 2. *Able to understand the meaning, scope, principles and functions of Islamic law.* 3. *Able to understand the importance of Islam rahmat lil 'alamin in the nation and state* 4. *Able to understand religious tolerance in Indonesia* 5. *Able to understand as a mosque the center of Muslim civilization* 6. *Able to understand the dangers and negative impacts of corruption* 7. *Able to understand the government system from an Islamic perspective* 8. *Able to apply Islamic values that are religious, honest, disciplined, tolerant and fair* 9. *Able to be responsible in carrying out daily life in accordance with their duties as servants of Allah and caliphs (leaders) on earth.* 10. *Able to analyze the importance of holding power as a mandate with*		

full justice *11.Able to fortify themselves from anti-Pancasila and NKRI movements.*

MPK60002	EDUCATION OF CATHOLIC RELIGION	2 CREDITS (2-0)
This course Improves understanding of the faith concept in the Church, life with the church behavior and socialized to develop personal attitudes of a Catholic scholar who can devote himself to the interests of the Indonesian people as an expression of his faith. ***Course Learning Outcomes (CLO):*** *1. Able to describe the scope of Catholic religious education* *2. Able to explain the Preaching of Jesus Christ* *3. Able explain the Apostles' stories and Al Kitab* *4. Able to explain the history of Catholicism* *5. Able to explaining Christian Life in society*		

MPK60003	EDUCATION OF PROTESTANT CHRISTIAN RELIGION	2 CREDITS (2-0)
Develop the application of Christian faith foundations to equip students so that able to grow as a whole person and a new creation in Jesus Christ. Improve accountability to God through his sensitivity toward others and their environment. Thus as academic human should go to the community by the dedication based on the service and honor and glory of God. ***Course Learning Outcomes (CLO):*** *1. Able to describe the scope of Protestant Christian education* *2. Able to explain the concept of divinity in Protestant Christianity* *3. Able to explain the concept of man in Christianity* **4.** *Able to explain Law in Christianity*		

MPK60004	HINDUISM EDUCATION	2 CREDITS (2-0)
History of Hinduism, Three basics framework of Hinduism, tatwa (philosophy), susila (ethics), yadya (ritual). Wada's description, the basic belief of Hinduism, panca srada, basic and purpose of human life, dharma Sidhartha, catur marga yoga, panca maha yadya, catur asram, catur warna. ***Course Learning Outcomes (CLO):*** *1. Able to describe the scope of Hindu religious education*		

2. *Able to explain Sradha, Susila, Yadnya, and Scripture* 3. *Able to explain describe of Saints and holy places* 4. *Able to explain cultural and historical development*

MPK60005	**BUDDHISM EDUCATION**	**2 CREDITS (2-0)**
Inception of Buddhism, epistemology, causality, life characteristic, rebirth karma, morality and ethics, nirvana, branching and characteristic of each stream, metaphysics, theology in Buddhism, Buddhist position in the repertoire of human knowledge, the relevance of Buddhism with modern times and the development era of Indonesia. ***Course Learning Outcomes (CLO):*** 2. *Able to explain describe of the scope of Buddhist education* 3. *Able to explain the history of the establishment of Buddhism* 4. *Able explains Buddhist belief (Saddha), Bhavana, and the law of karma* 5. *Able to explains describes the 31 of existence*		

MPK 60006	**CIVIC EDUCATION**	**2 CREDITS (2-0)**
Citizenship education has the aims to develop knowledge, understanding, and awareness of National Defense Security (HANKAMNAS) among the students within the framework of National Defense (TANNAS), in addition to develop and raise the awareness of national discipline. Hence, it is given to students the knowledge and understanding of Civics Education, Archipelago, National Security and Defense Strategy National Security Politics as a cornerstone in understanding the system of People's Defense and Security. ***Course Learning Outcomes (CLO):*** 1. *Able to understand the nature of civic education in development full ability of a scholar or professional and linking the values of Pancasila with the subject matter in the Citizenship Education course.* 2. *Able to interpret the concept of the Unitary State of the Republic of Indonesia and identify as well recognize the uniqueness of the Indonesian rule of law that is rooted in the values of Pancasila.* 3. *Able to understand the supremacy of the constitution and the*		

uniqueness of the State Constitution of the Republic of Indonesia 1945 which is rooted in the values of Pancasila and sorting out constitutional behavior and institution in the life of the nation and state. *4. Able to understand, identify, and defend national identity from popular culture in the flow of globalization.* *5. Able to build awareness and believe in the importance of involvement or participation in the practice of Pancasila democracy.* *6. Able to study Pancasila as the philosophical foundation of Human Rights in the State Indonesia and compromise between human rights and obligations in the life of the nation and patriotic.* *7. Able to understand geopolitical and geopolitical concepts in Indonesia and classify the potential for diversity of natural resources and human resources in the concept of regional autonomy based on insights Archipelago.* *8. Able to show a sense of love for the country, have nationalism, and a sense of responsibility to the state and nation.*

MPK60008	**PANCASILA**	**2 CREDITS (2-0)**
Pancasila courses are national compulsory courses that are included in the personality development course family. . This subject is required with the following backgrounds: (a) Historicality; as a nation that values history, the life of the nation and state can never be separated from the values instilled by the founding fathers; (b) Cultural; as a nation that has cultural roots and values, we must have a solid cultural foundation so that the national identity does not become extinct. (c) Juridical; in the statute of Universitas Brawijaya, it states the need to preserve the values of Pancasila; (d) Global Era, the various ideologies of the world that enter our lives can influence our view of the life of the nation and state, and even threaten the division of the nation, so that a philosophical basis for the state is needed.		
Course Learning Outcomes (CLO): *1. Able to analyze, compare, and reflect on the function and importance of Pancasila in the history of the nation* *2. Able to analyze the relationship between the philosophical nature of*		

the values of the Pancasila principles and use them as a tool for analyzing the nation's problems. 3. *Able to show a positive attitude and love the ideology of the Indonesian nation by applying the values of Pancasila in the academic environment* 4. *Able to understand, identify, and be accountable for the analysis of laws and regulations and policies that are idealistic, practical and pragmatic based on Pancasila* 5. *Able to build awareness of critical and innovative thinking in the development of science and technology based on the values of Pancasila*

MPK 60007	**INDONESIAN LANGUAGE**	**2 CREDITS (2-0)**
The course discusses grammar, syntax, spelling, systematic scientific article writing, usage of standard terms, foreign and local language transformation, and method of summary. ***Course Learning Outcomes (CLO):*** 1. *Able to show a positive attitude and love the Indonesian language by applying it in communication effective in an academic environment.* 2. *Able to understand and apply various languages in accordance with the context of use in formal / non-formal communication in the scientific field.* 3. *Able to critically read scientific field texts by relating them to previous schemata and contexts.* 4. *Able to evaluate texts in scientific and popular writing in accordance with correct grammar and spelling rules* 5. *Able to explore creative and innovative ideas in writing scientific or polular scientific works.* 6. *Able to produce scientific or popular writings systematically, logically, and empirically suitable for publication in journals and mass media.*		

UBU60004	**ENGLISH LANGUAGE**	**3 CREDITS (3-0)**
Ability to active communicate (oral and written) and also passive communicate (listening and reading) in English. Formal and informal oral presentation. Writing a scientific article/ report/ research. English for career purpose (job interview, writing job application, curriculum		

vitae etc.). ***Course Learning Outcomes (CLO):*** 1. *Able to describe the scope of English* 2. *Able to apply english Listening techniques* 3. *Able to apply basic english speaking / conversation* 8. *Able to apply reading techniques in English* 9. *Able to apply english writing techniques* 10. *Able to know and apply English grammar* 11. *Able to know and be able to prepare for the TOEIC / TOEFL / IELTS English test*

UBU60001	**BACHELOR THESIS**	**6 CREDITS (6-0)**
The thesis is a scientific work of implementation research (in the form of experiments and surveys) or scholarly reports of internship activities equipped with library research, under the supervisor's guidance. *Prerequisites: Have achieved at least 120 credits (proposal)* ***Course Learning Outcomes (CLO):*** 1. *Able to formulate problems* 2. *Able to search scientific literature and compile it systematically* 3. *Able to develop or design scientific activities* 4. *Able to analyze data, process, and interpret data* 5. *Able to discuss the results of data processing and interpretation* 6. *Able to draw conclusions from a discussion result* 7. *Able to present scientific thesis in written form* 8. *Able to present orally the final thesis plan and thesis implementation results*		

UBU60005	STUDENT COMMUNITY SERVICE (PKM)	4 CREDITS (4-0)

Student Community Service (KKN) is a community service activities in certain areas, it is carried out in groups, integrated between the Department, coordinated in the Faculty level, preferred non-physical activities in agriculture, aims to help people to improve their knowledge and skill that it is expected to improve their welfare. The activity is divided into 4 stages of activity: provisioning, implementation of activities at the site, and reports of the implementation and evaluation.
Prerequisites: Have taken at least 110 credits.

Course Learning Outcomes (CLO):

1. *Able to manage and cooperate with other disciplines*
2. *Able to identify potentials and problems that exist in partners / communities*
3. *Able to design partner / community empowerment according to local potential and based on local wisdom*
4. *Able to carry out partner / community empowerment programs based on local potential*
5. *Able to communicate with partners / communities in accordance with local manners and norms*
6. *Able to compile program activity and accountability reports*

TPF60016	INTERNSHIP (PKL)	3 CREDITS (3-0)

Job training in institutions or government agency or private agency or a student who practice his own agricultural cultivation with supervisor's assistance during a certain period.
Prerequisites: Have taken at least 100 credits

Course Learning Outcomes (CLO):

1. *Able to compile activity plans [field work reacts based on scientific basis in accordance with the student's scientific field*
2. *Able to make observations and analyze the results of observations*
3. *Able to connect theory with real practice in the field*
4. *Able to present observations, analysis of the relationship between theory and practice in the form of scientific writing*

TPE 61003	PHYSICS	4 CREDITS (3-1)

The course study about dimension and unit (scalar, vector), Newton Law, Equilibrium. Liquid: hydrostatic properties, molecule phenomena, surface tension. Thermodynamics: thermal and temperature, energy transformation, thermal transformation. Modern physics: quantum theory, nuclear radiation.

Course Learning Outcomes (CLO):

1. *Able to explain quantities and units and calculate cases related to using vector algebra*
2. *Able to explain and calculate classical mechanics topics for rigid objects*
3. *Able to explain and calculate classical mechanics topics for flow objects*
4. *Able to explain and calculate thermal physics topics*
5. *Able to explain and calculate wave physics topics*
6. *Able to explain and calculate electric and magnetic physics topics*
7. *Able to calculate, demonstrate, and conclude the correct measurement method*
8. *Able to calculate, demonstrate, and conclude the addition of force vectors*
9. *Able to calculate, demonstrate, and conclude Archimedes law experiments*
10. *Able to calculate, demonstrate, and conclude thermal expansion experiments*
11. *Able to calculate, demonstrate, and conclude experiments of ohms and Kirchoff's law*

TPF 61006	PRACTICAL PHYSICS	1 CREDIT (0-1)

This practicum discusses the law of archimdes, bouyanci law. And prove the law in an experiment. And there are experiments on electrical circuits *to find out the value of Ohm (resistance), current, and voltage. Kurchoff's law is also applied to electrical circuits.*

Course Learning Outcomes (CLO):

1. *Able to calculate, demonstrate and deduce the correct measurement method*
2. *Able to calculate, demonstrate, and conclude the experiment of adding force vectors*
3. *Able to calculate, demonstrate and conclude Archimedes law experiments*
4. *Able to calculate, demonstrate and conclude thermal expansion experiments*
5. *Able to calculate, demonstrate, and deduce experimental Ohms and Kirchoff's laws*

TPF 61003	BASIC CHEMISTRY	3 CREDITS (2-1)

General chemistry is designed to introduce the fundamental principles of chemistry, inorganic, physical, and analytical chemistry. In this course, topics studied are understanding of matter, composition, structure of matter element and compound, chemical bonding. It covres atomic theory, solution and concentration, pH solution, oxidation-reduction reaction, electrochemical, chemical equilibrium, kinetics reaction. Stoichiometry, quantitative and qualitative chemical analysis includes volumetric (standard solution, alkalimetric and acidimetric analysis), and gravimetric (precipitation) analysis.

Course Learning Outcomes (CLO):

1. *Able to explain and discuss distinguishing types of substances, compound elements, solutions and mixtures, can explain atomic structure and can understand the periodic system of elements*
2. *Able to formulate, demonstrate and demonstrate technical principles and methods of analysis and control of chemical reactions that occur in agricultural technology*
3. *Able to explain and apply chemical reactions related to damage mechanisms and shelf life of food / agricultural products*
4. *Able to analyze and present the meaning of reaction kinetics, reaction order, reaction rate, able to determine the order of a reaction, able to determine the rate of reaction and rate constants of a reaction, to determine the rate of reaction in an enzymatic reaction*

TPF 61004	PRACTICAL OF BASIC CHEMISTRY	1 CREDIT (0-1)

In this practicum course, students learn about the basic principles of work in the Laboratory. Students learn about the tools in the laboratory and K3 culture. Students are able to make solutions with a certain concentration, principles Alkalimetric acid, buffer solutions, oxidation reduction reactions and concentration determination substances by the spectrophotometric method.

Course Learning Outcomes (CLO):

1. *Able to explain the names and functions of the tools used in practicum*
2. *Able to carry out titration techniques correctly such as determining the end point of the titration and the titration volume*
3. *Able to make a solution from liquid, solid materials, and have accuracy in carrying out the dilution steps*
4. *Able to using a pH meter and use pH meter for calibration*
5. *Able to identify the changes that occur during the reaction using metal color indicators and solutions*
6. *Able to determine the concentration of a compound and accuracy in the use of a spectrophotometer*

TPF 61001	BIOLOGY	3 CREDITS (2-1)

The course covers living organization, classification in biology. Function and structure of plant and animal. Reproduction system, molecular biology. Biosphere. Organism and environment. Role of biology in agriculture, industry and natural resources, environmental impact of assessment (EIA). Conservation and construction. Basic ecology. Energy flow and material cycles. The response of ecosystems to environmental technology and environmental adaptation tolerance law.

Course Learning Outcomes (CLO):

1. *Able to explain the definition of biology and its relationship with other sciences*
2. *Able to explain the organic materials that make up organisms*
3. *Able to explain cells and microorganisms divide and multiply*

4. *Able to explain the structure and function of plants in agricultural technology* 5. *Able to explain definition and benefits of biotechnology in agricultural technology and the environment*

TPF 61002	**PRACTICAL OF BIOLOGY**	**1 CREDIT (0-1)**
This practicum course studies the use of microscopes and methods perform micrometer calibration, microorganism cell structure, plant tissue, animal tissue, respiration and photosynthesis, biodiversity in ecosystems waters, as well as the interaction of biotic components in an ecosystem. ***Course Learning Outcomes (CLO):*** 1. *Able to demonstrate use of microscope* 2. *Able to analyze microorganism cell structure* 3. *Able to analyze environmental factors that influence the adaptation and evolution of organisms*		

TPF 62008	**ORGANIC CHEMISTRY**	**3 CREDITS (2-1)**
The concept of chemical bonds (definition of chemical bonds, ionic, covalent coordinates, understanding of polarity, etc.). The reactions in organic molecules, isometric, and stereoisomers, groups of compounds based on functional groups, biomolecular compounds, and other natural compounds (alkanes, alkenes, alkenes, organic acids, esters, ether, etc.) along with an explanation of their respective structures. ***Course Learning Outcomes (CLO):*** 1. *Able to formulate, demonstrate and demonstrate structure and reactions and reactivity of organic compounds* 2. *Able to explain and apply the relation of chemical reactions to the mechanism of damage and the shelf life of food / agricultural products* 3. *Able to analyze and present alkanes, alkenes, alkyne, alcohol, ether, aldehyde, ketones, carboxylic acids, esters, aromatic compounds, organic halogen compounds, stereochemistry,*		

polymers. Reactions in organic molecules		

TPF 60011	ENGINEERING ECONOMICS	3 CREDITS (3-0)

This course contains the definition and use of the techniques of economic analysis, equivalence, equivalence an alternative, alternative selection, analysis of capital controls, depreciation, taxes, economic age, the use of cost analysis, analysis of point return and minimum cost analysis, sensitivity analysis of inflation and principal. The relationship between the time value of money and the interest rate of capital. Cost analysis tools and agricultural machinery, production analysis. Analysis of alternative methods of B / C, Break-Even Point (BEP), the evaluation of agricultural projects.

Course Learning Outcomes (CLO):

1. *Able to apply calculations using the interest formula, cost concept, annual and present value equivalents, ROR, depreciation, tax, inflation, BCR, BEP, sensitivity analysis, and other technical analysis in solving agricultural technology problems*
2. *Able to interpret engineering economics in business and project evaluation in the field of agricultural technology*

TPF 61014	RESEARCH METHOD AND SEMINAR	2 CREDITS (2-0)

In this subject, the ways of doing scientific research, including the determination of the problem, identifying research variables can design experiments and experiment with various types of experimental design such as RAL, RAK, Factorial, nested and Shuffle able to test the experiment with non-parametric (Friedman test, Wilson and different test: t test, LSD and DMRT) and non-experimental design, observation and data collection, interpretation of results of analysis experiments.

Course Learning Outcomes (CLO):

1. *Able to recognize, know and understand the structure of scientific knowledge*
2. *Able to know, know and understand about various methods and types of research*
3. *Able to know and understand about experimental and pre-experimental designs*

4. *Able to know and understand about research steps* 5. *Able to know and understand and explain the role of statistics in research* 6. *Able to compile scientific reports*

TPE 62043	**OPERATIONAL RESEARCH**	**2 CREDITS (2-0)**
Solving problems to optimize the use of limited resource availability with linear programming (linear programming) using the simplex method and its application in a particular form: the transportation problem, the assignment (and time division multiple), and transshipment.		
Course Learning Outcomes (CLO): 1. *Able to understand basic concepts in Operations Research and methods used for problem-solving* 2. *Able to apply methods of determining objective functions, decision variables, and limiting functions to formulate a problem in linear form in a case example* 3. *Able to solve optimization problems through Linear Programming methods (graph method, Simplex table, VAM-NWCR transportation method, Stepping Stone, MODI, queuing theory, and transshipment model)* 4. *Able to evaluate optimization results with linear programming and its application in case studies in the agribusiness and agroindustry fields*		

TPE 61002	**BASIC MATHEMATICS**	**2 CREDITS (2-0)**
This course explains about functions, inverse functions, composition functions, quadratic functions, exponential functions, logarithmic functions, trigonometric functions, lines and series, limits, logical mathematics, Taylor series, Newton Rapson		
Course Learning Outcomes (CLO): 1. *Able to understand and calculate mathematical function proble logarithmic and trigonometric)* 2. *Able to understand the concept of limits and calculate limit problems* 3. *Able to understand and calculate mathematical logic series problems*		

TPE 62029	**ERGONOMIC AND OCCUPATIONAL HEALTH AND SAFETY**	**2 CREDITS (2-0)**
This course has a subject covering the elements of K3. The basics of K3 safety. The aims and objectives of SMK3 / OHSAS 18001: 2007. SMK3 introduction and interpretation. SMK3 preparation method. Manage SMK3 performance in the workplace. Hazard identification and risk assessment. Implementation and certification of SMK3. The body's work system. The working system of the human mind. The human sensory system, the interaction of the human body with the environment. Body rhythm and work shift. Work design principles are based on the human body. Man-machine system. Handling of physical loads. Cognitive aspects of ergonomics. Ergonomics checklist. Ergonomics applications in the hospitality sector, agribusiness, and industry. Cognitive work analysis. Work analysis approach. Bad design related to cognitive ergonomics. Kansei engineering and its applications. Emotional design. Mental workload measurement. Canoe method		
Course Learning Outcomes (CLO): *1. Understand the basics of ergonomics and K3 in agricultural technology* *2. Able to understand and calculate machine and human work systems through a work analysis approach* *3. Able to understand the principles of work design based on the human body* *4. Able to identify types of hazard and understand the method of compilation of K3 management system* *5. Able to work together in groups professionally (A2) and able to provide ideas related to ergonomics and K3 in agricultural technology*		

UBU 60003	**AGRO-INDUSTRIAL ENTREPRENEURSHIP**	**3 CREDITS (2-1)**
This course studies the characteristics of successful entrepreneurship (building dreams and pursuing ideals, motivating yourself, solving problems and running a business), intrapersonal skills (communication, leadership, and entrepreneurial motivation), developing creativity and innovation in creating superior service products, entrepreneurial		

marketing (personal and corporate), as well as entrepreneurial management (financial management, evaluation and business development).
Course Learning Outcomes (CLO): *1. Able to understand the concept of entrepreneurship and the challenges of entrepreneurship in the modern era* *2. Able to understand the character of successful entrepreneurship* *3. Able to understand the concepts and functions of leadership in entrepreneurship* *4. Able to understand the concepts and functions of communication in entrepreneurship* *5. Able to understand and understand the importance of motivation in entrepreneurship* *6. Able to understand the concepts and functions of creativity and innovation in entrepreneurship*

TPF 60015	**PRACTICAL AGRO-INDUSTRIAL ENTREPRENEURSHIP**	**1 CREDIT (0-1)**
This practicum teaches starting a business with a business group. Starting from the process of idea formation, product production, marketing, business reporting. Creating products that are unique so they can last over time. ***Course Learning Outcomes (CLO):*** *1. Able to apply the concept of lean startup in starting an entrepreneurial business* *2. Able to apply the concepts and functions of networking in entrepreneurship* *3. Able to apply the concepts and functions of business financial management in entrepreneurship* *4. Able to apply the concepts and functions of business marketing management in entrepreneurship* *5. Able to apply the concepts and functions of business management in entrepreneurship*		

TPE 62058	**ROBOTICS IN BIO-SYSTEM**	**3 CREDITS (2-1)**

This course explains the basics of developing bio-production robots; robot components; manipulators, end-effectors, sensors, traveling devices, control devices, and actuators. Image acquisition; robots in bio-production in controlled environments; robots for open-area bio-production; robots in the food industry. Prerequisite: TPE 62022, TPE 62023/ TPO 62017, TPO 62018
Course Learning Outcomes (CLO): *1. Able to explain the basics of bioproduction robot development.* *2. Able to explain the components and functions of the manipulator, end-effector, sensor, traveling device, control.* *3. Able to apply image acquisition robotics and algorithms in bioproduction or the food industry.*

TPE 62059	**PRACTICAL ROBOTICS IN BIO-SYSTEM**	**1 CREDIT (0-1)**
Practicum is designed to study electronics and instrumentation and introduction of resistors as electronic components. Identification of the parts of the instrumentation system (Sensing element, signal conditioning element, signal processing element, and display) and design into a robot agrobiosystem *Prerequisite: TPE 62022, TPE 62023/ TPO 62017, TPO 62018* ***Course Learning Outcomes (CLO):*** *1. Able to explain and conclude electrical circuits related to resistors, and the introduction of other passive electronic components* *2. Able to calculate, demonstrate, and conclude Digital electronic components (decoder, encoder, and 7 segments)* *3. Able to calculate, demonstrate, and conclude the parts of the instrumentation system (Sensing element, signal conditioning element, signal processing element, and display)* *4. Able to calculate, demonstrate, and conclude data acquisition system and data logger* *5. Able to calculate, demonstrate, and conclude capita selecta instrumentation system related to agricultural engineering*		

TPE 61010	**THERMODYNAMICS**	**3 CREDITS (2-1)**

The basic concepts of thermodynamics, energy forms, systems, processes, and thermodynamic cycle, the system unit, pressure and temperature, properties of pure substances and characteristics of an ideal gas, the first law of thermodynamics in a closed system, includes heat, work, specific heat, energy, enthalpy and specific heat of an ideal gas, the Laws of Thermodynamics I open system (volume control), the second law, the reservoir of heat energy (thermal energy reservoirs), heat engines (heat engines), engine cooling and heat pump, (refrigerators and heat pumps), a perpetual motion machine (perpetual-motion-machines), Carnot cycle, Carnot's principle, Carnot heat engine, refrigeration and heat pump Carnot. Prerequisites: TPE61002, TPE61003, TPF61006
Course Learning Outcomes (CLO): *1. Able to explain the basic concepts of thermodynamics, understand the Law of Thermodynamics and the system of thermodynamics* *2. Able to understand and explain reversible and irreversible processes* *3. Able to understand the position and determination of the working fluid in the p-v or T-s field and be able to read the physical properties table* *4. Able to analyze various kinds of thermodynamic cycles* *5. Able to apply thermodynamics of unreacted mixtures* *6. Able to apply the Psychrometry concept to the process of decreasing and increasing RH, AC, and Cooling Towers* *7. Able to apply thermodynamic principles in technological innovation and calculate the effectiveness and efficiency of products*

TPE 62004	**CALCULUS 1**	**2 CREDITS (2-0)**
This course covers the basic theorems of calculus, area, and volume of rotating objects, transcendent functions: logarithms, exponents, and trigonometry, techniques, integration, Laplace transforms, principles of transformations and inversions, laws of linearity, transformations for derived functions, and integrals. Students should able to solve differential equations and integrals. *Prerequisite: TPE 61002*		
Course Learning Outcomes (CLO): *1. Able to understand and calculate real and complex number problems* *2. Able to understand and calculate matrix problems*		

3. *Able to understand and calculate derivatives and integrals* 4. *Able to understand and calculate solutions of 1st order differential equations*

TPE 61018	CALCULUS 2	3 CREDITS (2-1)
This lecture provides learning techniques for solving complex derivatives, such as derivatives for functions with two or more variables. The scope of other materials is multiple integrals that include triple integrals in cartesian, cylindrical, and spherical coordinates. The Laplace method is the third subject matter given in this course. *Prerequisite TPE 62004.*		
Course Learning Outcomes (CLO): 1. *Able to understand and calculate solutions of Order 2 differential equations* 2. *Able to understand and calculate solutions of High Order differential equations* 3. *Able to understand and calculate partial differential equation solutions* 4. *Able to understand basic laplace transform theory and apply laplape transform to solve differential equations*		

TPF 60007	PERSONALITY DEVELOPMENT AND PROFESSIONAL ETHICS	2 CREDITS (2-0)
This course contains the definitions and definitions of ethics and morals, code of ethics, and professionalism. Implement a professional code of ethics in an institution (including student ethics, lecturer ethics, educational ethics, lecture ethics), material on intelligence, personality, communication, and empathy concerning professional ethics. This course also discusses the status of standardization of professions and professional organizations (national and international).		
Course Learning Outcomes (CLO): 1. *Able to understand the meaning and dynamics of personality and personal development and can obtain appropriate knowledge of the totality of themselves* 2. *Able to explain the meaning of morals, ethics, morals, and their urgency in life* 3. *Able to the impact of ethics / morals on all aspects of life*		

6.	*Students can get to know themselves better and understand various kinds of self-motivation*
7.	*Able to prepare to enter the world of work*

TPF61012	**BIOMATERIAL**	**2 CREDITS (2-0)**
This course contains an introduction to biomaterials science, definitions in the fields of biosystems and medicine; classification, structure and basic properties of biomaterials; methods of testing the biological, physical and chemical properties of biomaterials; structure and properties of biometal, bioceramics, biopolymers, bioplastics; application of biomaterials as anti-biofouling, biosensors, drug delivery, bioseparations, biomethane, biohydrogen, bioethanol and biodiesel. ***Course Learning Outcomes (CLO):*** 1. *Able to explain and discuss the definition of biomaterials and bioproducts, their classification and characteristics* 2. *Able to formulate, show and demonstrate methods of characterizing the biological, physical and chemical properties of biomaterials* 3. *Able to explain and apply the principle of converting biomass into bioproducts* 4. *Able to analyze and present research results in the application of biomaterials individually and in groups*		

TPP62014	**QUALITY MANAGEMENT SYSTEM AND HALAL ASSURANCE**	**2 CREDITS (2-0)**
Concept and definition of quality, history of quality development, quality terminology, scope of quality control operations, quality-process and control links, quality attributes of food products and product quality standards. In addition, the introduction of quality systems, halal systems, the definition of accreditation and		

certification, quality audits, writing quality management system documents and manufacturing quality manuals, ISO 9000: 2008 QMS standards, ISO 22000 and ISO 14000 and certification procedures will also be discussed in general as well as discussion. various food regulations used in international trade. This course also studies the halal guarantee system in the food industry. Topics discussed include the definition and purpose of halal certification, policies and regulations and related institutions, certification mechanisms and their applications, requirements, and issues and developments in the halal assurance system in Indonesia and the world.

Course Learning Outcomes (CLO):

1. *Able to explain the quality management system*
2. *Able to explain the types of quality assurance and ISO standards in the food industry*
3. *Able to describe the need for quality documents and certification procedures*
4. *Able to explain the system and development issues of halal assurance in Indonesia*

TPO61001	INTRODUCTION TO BIOPROCESS ENGINEERING	2 CREDITS (2-0)

This course contains the development of bioprocesses in an interdisciplinary perspective. The basic engineering calculations applied in biological processes, physical process processes, fluid flow, heat, mass transfer, and operating units, the principles of bioreactors, bioreactor systems, basic bioreactor design, bioprocess scale multiplication, and bioprocess controlling.

Course Learning Outcomes (CLO):

1. *Able to understand and explain the definition of bioprocess techniques and their position in the scientific tree, including biosystem engineering*
2. *Able to explain aliphatic compounds, functional groups, and organic compounds.*
3. *Able to analyze and present the principles of bioprocess engineering.*
4. *Able to understand and explain bioprocess engineering development in the educational world and industry to support a bio-based*

economy.

TPO61002	ENGINEERING MECHANICS	3 CREDITS (2-1)

This course studies the equilibrium that affects bioreactor system (concurent, parallel, non-concurent non-parallel), work and energy in the bioreactor, and analysis of bioreactor strength materials.

Course Learning Outcomes (CLO):

1. *Able to explain, make schemes, and calculate the concept of vector operation in a force-balanced system.*
2. *Able to explain, make schemes, and calculate dynamic system parameters/moving objects.*

TPO62003	FOOD CHEMISTRY	2 CREDITS (2-0)

This course studies the knowledge about chemical structure, physicochemical properties, chemical reactions, the role/function of chemical components of food, and food products. The water, carbohydrates, proteins, fats, vitamins, minerals, and other components and their processing changes will be discussed studied. The changes include denaturation, rancidity, retrogradation, syneresis gelatinization, hydrocolloid properties, off-flavor, and browning. This course also briefly discusses the interactions between chemical components in food products.

Course Learning Outcomes (CLO):

1. *Able to mention and explain chemical compounds in food ingredients.*
2. *Able to explain the interactions that occur between chemical components in food products during processing.*
3. *Able to apply the principles of food chemistry to design food bioproducts.*

TPO62004	ESSENTIAL MICROBIOLOGY	2 CREDITS (2-0)

This course studies the basics of microbiology, understanding and scope of microbiology, types of microbes, biochemical principles, structure and composition of prokaryotic and eukaryotic cells, microbial nutrition, microbial cultivation, microbial growth, microbial metabolism, microbial control, microbial genetics, and microbial applications in the industry. ***Course Learning Outcomes (CLO):*** 1. *Able to explain and discuss the definition of microbiology, the scope of microbiology, the properties of microbes.* 2. *Able to explain and apply microbiology for upstream processes in the bioprocess field.* 3. *Able to formulate, demonstrate and demonstrate the principles of cultivation, growth, microbial control.*

TPO62005	**ESSENTIAL MICROBIOLOGY LAB WORK**	**2 CREDITS (2-0)**
This course provides basic practice of identification, isolation, microbial cultivation, and application to bioprocess engineering. ***Course Learning Outcomes (CLO):*** 1. *Able to characterize the properties of microbes* 2. *Able to elaborate the principles of cultivation, growth, microbial control.* 3. *Able to apply microbiology for upstream processes in the bioprocess field*		

TPO62006	**INTRODUCTION TO COMPUTER APPLICATION**	**2 CREDITS (0-2)**
This course studies computer science and computation, the introduction of hardware in computers and software in computing. Computer application for statistical, mathematical, and numerical analysis. Use of computers to create graphs, tables, scientific presentations, and computation to solve the problems in the bioprocess industry. ***Course Learning Outcomes (CLO):*** 1. *Able to explain basic concepts of computer hardware and software.* 2. *Able to explain and create simple algorithm schemes using flow charts.* 3. *Able to explain and create simple application and/or database programs.*		

4. *Able to know and explain IC3 test.*

TPO62007	PRACTICAL OF INTRODUCTION TO COMPUTER APPLICATION	1 credit (0-1)

This course provides a basic practice of introducing computer hardware and software computation to solve the bioprocess industry's problems.

Course Learning Outcomes (CLO):

1. *Able to use basic concepts of computer hardware and software.*
2. *Able to create simple algorithm schemes using flow charts*
3. *Able to create a simple database application using computer software*

TPO61008	TRANSPORT PHENOMENA 1	2 CREDITS (2-0)

This course explains the basic concepts and properties of fluids, fluid statics, fluid kinematics, fluid dynamics, diffusivity and mass transfer mechanisms, the distribution of concentrations in laminar and turbulent flows. Prerequisite: TPE61003.

Course Learning Outcomes (CLO):

1. *Able to understand and explain the definition and principles of the movement phenomenon.*
2. *Able to analyze and present the basic laws of movement, momentum, energy, and mass.*
3. *Able to understand and explain the movement phenomenon in the field of bioprocess engineering.*

TPO61009	COMPUTER AIDED DESIGN (CAD)	2 CREDITS (2-0)

This course studies the introduction of CAD, History, Uses, and Software, Introduction to CAD program graphic interfaces (Start, Organize, Save, Control Drawing views, units, toolbars), Operating CAD software to create basic 2D drawing objects with basic tools, inclusion dimensions, format, properties, viewports, commands and image modification. Techniques for serving 2D images and plotting. The introduction of 3D objects includes definitions of functions and benefits; 3D Solid Objects

(Box, Sphere, Cylinder, Cone, Wedge, Torus); Get to know 3D modification (3D VIEW, 3D SURFACE, 3D RENDERING; Advanced 3D modification for various types of objects; 3D modification with commands; Layering system; 3D image presentation and plotting techniques. ***Course Learning Outcomes (CLO):*** *1. Able to identify the use of drawing tools* *2. Able to identify principles of engineering drawing according to ISO standard* *3. Able to prepare design of engineering drawing* *4. Able to create design of machinery components using software*

TPO61010	PRACTICAL OF COMPUTER AIDED DESIGN (CAD)	1 CREDITS (0-1)
This course provides practical operation of CAD software from basic tools, image modification and presentation. ***Course Learning Outcomes (CLO):*** *1. Able to identify the use of drawing tools* *2. Able to identify principles of engineering drawing according to ISO standard* *3. Able to prepare design of engineering drawing* *4. Able to create design of mechanical components using software*		

TPO61011	AUTOMATION 1	2 CREDITS (2-0)
This course studies the basics of electronics and instrumentation, data acquisition and data processing, the principles of physical, chemical and biological measurement in bioreactors, an understanding of analog and digital data, and the basic principles of electronic components and instrumentation. ***Course Learning Outcomes (CLO):*** *1. Able to explain the working concept of basic electronic components.* *2. Able to explain, make diagrams, calculate, assemble, and measure by applying the basic theory of electronics.* *3. Able to explain, make diagrams, discuss parts of the instrumentation system.*		

4. *Able to explain, create schemes, arrange, evaluate instrumentation systems.*

TPO61012	PRACTICAL OF AUTOMATION 1	1 CREDITS (0-1)

This course provides basic practice of electronics and physical, chemical and biological measurements in bioreactors.

Course Learning Outcomes (CLO):

1. *Able to use basic electronic components*
2. *Able to assemble electronic components into instrumentation determined*

TPO61013	BASIC BIOCHEMISTRY	2 CREDITS (2-0)

This course studies carbohydrates, proteins, fats, glycolysis, gluconeogenesis, phentose, phosphate pathway, photosynthesis processes, metabolism, citric acid cycle, fatty acid oxidation, and amino acid biosynthesis.

Course Learning Outcomes (CLO):

1. *Able to understand and explain the principles of science (biochemistry) in identifying, formulating and solving problems in the field of bioprocess engineering.*
2. *Able to analyze and present the biochemical reactions that occur in a compound.*
3. *Able to understand and explain knowledge about biochemistry.*

TPO62014	APPLIED MATHEMATICS IN BIOPROCESS	3 CREDITS (2-1)

This course provides knowledge about the review of Ordinary and Partial Differential Equations. Application of Order 1 Ordinary Differential Equations in Fluid Problems, Heat Transfer Problems, Kinematics and dynamics, Electrical Problems, Growth and Death Models of Microorganisms, Application of PD to reaction rates, First order reaction kinetics, Review of Order 2 Differential Equations. Application of Order 2 Ordinary Differential Equations in 2nd order reaction kinetics problems, RCL circuit electrical problems, problems in the form of partial differential equations, 1-dimensional conduction cases in

Cartesian coordinates and cylinder coordinates.
Prerequisite: TPE61018
Course Learning Outcomes (CLO):
1. *Able to elaborate all of basic mathematics knowledge, calculus 1 and 2 to solve engineering problems.*
2. *Able to make a model from various engineering problems in the form of differential equations.*
3. *Able to solve differential equation models that involve both boundary conditions and initial conditions, both in the form of ordinary differential equations and partial differential equations.*
4. *Able to demonstrate list structures, tuple, and dictionary.*
5. *Able to make dynamic equations from the model.*

TPO62015	**CHEMICAL REACTION ENGINEERING**	**3 CREDITS (2-1)**

This course consists of several subjects, which include an introduction: understanding kinetics review and thermodynamic review, chemical reaction kinetics, chemical reaction thermodynamics, catalysts, biocatalysts, bioreactors, enzymatic reaction kinetics.
Course Learning Outcomes (CLO):
1. *Able to explain and discuss the definition of chemical reactions, types and properties.*
2. *Able to formulate, show and demonstrate technical problems in chemical reactions.*
3. *Able to explain and apply chemical reaction kinetics, chemical reaction thermodynamics, catalysts, biocatalysts, bioreactors, enzymatic reaction kinetics.*
4. *Able to analyze and present research results in relation to the formulation of Chemical Reaction Engineering individually and in groups.*

TPO62016	**TRANSPORT PHENOMENA 2**	**2 CREDITS (2-0)**

This course is a continuation of the transport phenomenon 1, which explains more about thermal conductivity and heat transfer mechanisms; thermal conductivity of gases, liquids, and solids; Natural convection and forced convection; heat distribution in solids; Heat distribution in laminar and turbulent flow; viscosity theory and moving momentum; velocity distribution in laminar and turbulent flow; equations of

continuity, motion and mechanics; theory and properties of liquid polymers.
Prerequisite: TPO61008

Course Learning Outcomes (CLO):
1. *Able to explain and elaborate on mass flow, including mass concentration, velocity and flux.*
2. *Able to explain and understand about Fick's Law related to the diffusivity coefficient.*
3. *Able to explain and discuss solid material concentration distribution in laminar flow.*
4. *Able to explain the equation of change for multicomponent systems related to the diffusion process associated with energy, pressure, force and simultaneous equations for heat and mass transfer.*
5. *Able to explain the distribution of velocity, temperature, and concentration in laminar conditions with several variables more than one (in steady and unstable state).*
6. *Able to explain the transport of momentum, energy, and mass in turbulent conditions with two variables (steady and unstable).*

TPO62017	**AUTOMATION 2**	**2 CREDITS (2-0)**

This course studies the basics of control systems, various control algorithms, monitoring and control of the fermentation process, feedback control, indirect metabolic control, programmatic control, artificial intelligence applications in bioprocess control, bioreactor control applications from the measurement results of physical, chemical and biology.
Prerequisite: TPO61011.
Course Learning Outcomes (CLO):
1. *Able to explain, make diagrams, calculate mathematical models of systems.*
2. *Able to explain, and calculate dynamic system response.*
3. *Able to design and analyze control systems for bioreactor cases.*
4. *Able to explain various kinds of up-to-date concepts of modern bioprocess control systems.*

TPO62018	**PRACTICAL OF AUTOMATION 2**	**1 CREDITS**

		(0-1)

This course provides basic control systems from the measurement results of physical, chemical, and biological quantities.
Prerequisite: TPO61012
Course Learning Outcomes (CLO):
1. *Able to identify characteristics sensor and actuator*
2. *Able to create a simple control system using sensor and actuator*

TPO62019	**OPERATIONAL MANAGEMENT**	**2 CREDITS (2-0)**

This course discusses the definition and scope of operations management in the bioprocess industry, operations strategy, product design and selection processes (manufacturing and services), methods of determining factory locations, capacity planning, forecasting, aggregate and disaggregation planning, inventory control (deterministic, probabilistic and uncertainty), MRP II and CRP, scheduling (labor and machinery), production on time.
Course Learning Outcomes (CLO):
1. *Able to understand and explain the operational management function and its relationship with the organization's operating strategy adopted by the organization.*
2. *Able to explain, analyze, and discuss product design and development.*
3. *Able to understand and explain quality concepts, quality management principles and quality management implementation.*
4. *Able to explain and calculate site selection methods, capacity planning, scheduling, aggregate planning, inventory management and forecasting.*
5. *Able to explain, calculate and evaluate operational activities in the organization.*

TPO61020	**PRACTICAL OF OPERATIONAL MANAGEMENT**	**1 CREDITS (0-1)**

This course provides operational management practices in the bioprocess industry.

Course Learning Outcomes (CLO):

1. *Able to apply the capacity planning, scheduling, aggregate planning, inventory management and forecasting using several computer software*

TPO61021	BIOPROCESS UNIT OPERATIONS	2 CREDITS (2-0)

This course provides knowledge and understanding of bioprocess operation units' definition with a discussion of black box diagram philosophy, dimensional units, engineering approach methods, basics of momentum transfer, basics of thermodynamics and heat transfer, heat exchangers, evaporation, drying, mixing. and homogenization, solid-liquid separation (crystallization, filtration, adsorption), liquid-liquid separation (extraction, distillation, filtration membrane). Bioprocess production layout.

Course Learning Outcomes (CLO):

1. *Able to explain and discuss the definition of unit operations in bioprocess.*
2. *Able to formulate, demonstrate and demonstrate various operating units in bioprocess.*
3. *Able to explain and apply the principles of the bioprocess operation unit to produce bioproducts.*

TPO61022	PRACTICAL OF BIOPROCESS UNIT OPERATIONS	1 CREDITS (0-1)

This course provides operational practice for basic units in bioprocess engineering, especially for upstream processes.

Course Learning Outcomes (CLO):

1. *Able to carry out experiments by sundry unit operations*

TPO61023	BIOSEPARATION ENGINEERING	2 CREDITS (2-0)

This course explains several separation techniques in the bioprocess industry both in the upstream and downstream processes, the principles of bioseparations and their differences with chemical separation, including the separation of solids, liquids, solids-liquids such as sedimentation, centrifugation, distillation, absorption and adsorption, *chromatography, ordinary filtration, membrane filtration and crystallization.*

Course Learning Outcomes (CLO):

1. *Able to explain and discuss the definition of bioseparations and types of separation.*
2. *Able to formulate, show and demonstrate various types of separation techniques applied in the separation process.*
3. *Able to explain and apply the principles of bioseparations techniques in identifying, formulating, and solving problems in the field of bioprocess engineering.*
4. *Able to analyze and present the most suitable separation method to solve problems related to separation in bioprocess engineering.*

TPO61024	PRACTICAL OF BIOSEPARATION ENGINEERING	1 credit (0-1)

This course provides operational practice for separation units in the bioprocess field.

Course Learning Outcomes (CLO):

1. *Able to perform presentation of data, measures of central tendency and variability*
2. *Able to use the concept of probability and probability distribution*

TPO61025	ITERATION METHOD	2 CREDITS (2-0)

This course provides descriptions of the differences between analytic and iterative methods, interpolation, extrapolation, partial differential equations, differential integral iterations, roots of equations and non-linear equations, examples of applications of iterative solving in differential and integral equations. Prerequisite: TPE61004.

Course Learning Outcomes (CLO):

1. *Able to explain the fundamental difference between iterative solving and analytic solving.*
2. *Able to explain, solve, mathematical problems using iteration methods.*
3. *Able to apply and discuss the use of iteration methods on bioprocess problems.*
4. *Able to evaluate the advantages and disadvantages of using comparative methods.*

TPO61026	BASIC FERMENTATION TECHNOLOGY	2 CREDITS (2-0)

This course provides an understanding of the importance of fermentation in the industry. The principle of fermentation, types of fermentation. Biological materials/agents for the fermentation process, microorganisms in fermentation. Fermentation methods and techniques, substrate handling, starter, medium, and inoculation. Sterilization. Fermenter design and control, fermentation kinetics, process control, separation equipment in fermentation. Fermentation technology applications in industry (food, biomass, non-food). Prerequisite: TPO62004, TPO61013.

Course Learning Outcomes (CLO):

1. *Able to understand and explain the principles of science (fermentation) in identifying, formulating, and solving problems in the field of bioprocess engineering.*
2. *Able to analyze and design bioreactors (fermenters) and their components, systems and processes.*
3. *Able to understand and explain problems related to fermentation technology in the field of bioprocess engineering.*

TPO61027	INSTRUMENT ANALYSIS	3 CREDITS (3-0)

This course provides basic knowledge to do an analysis using instruments, components, working principles, interpretation of the results of several component analysis tools (FTIR, GC, LC, MS, HPLC, NMR, XRD, XRF), microscopy (SEM, TEM), thermal analysis (DSC, DTA, TGA), porosity (BET, surface area analyzer), texture (texture analyzer). ***Course Learning Outcomes (CLO):*** *1. Able to explain the definitions and working principles of various instruments to analyze physical, chemical, and biological quantities.* *2. Able to explain the application of various instruments for analysis of bioprocess and biomaterial.* *3. Able to analyze and present the selection of appropriate instruments to characterize materials and processes in the bioprocess field.*

TPO61028	**EXPERIMENTAL DESIGN**	**2 CREDITS (2-0)**
This course provides an introduction to statistics; Regression and correlation analysis; ANOVA; Experimental design (DOE); Evaluate research topics and problem boundaries; Factor selection, level and response; Measurement errors on factors and responses; Ranking of factors; basic experiments and mathematical models; full and partial factorial based experiments; statistic analysis; optimization (RSM, Taguchi). ***Course Learning Outcomes (CLO):*** *1. Able to explain, use, and demonstrate statistical methods for experimental design.* *2. Able to explain and operate experimental design software.*		

TPO61029	**PRACTICAL OF EXPERIMENTAL DESIGN**	**1 credit (0-1)**
This course teaches about research design practice and statistical analysis in the field of bioprocess engineering. ***Course Learning Outcomes (CLO):*** *1. Able to explain waste treatment technology according to waste type and characteristics* *2. Able to calculate needs and design aerobic and anaerobic waste treatment systems*		

TPO61030	FUNDAMENTALS OF BUSINESS MANAGEMENT	2 CREDITS (2-0)

This course explains the basics of business management, business definitions, the nature and types of business activities, the role of bioprocess business in bioeconomic development, business characteristics in the bioprocess field, and factors affecting business performance bioprocess industry.

Course Learning Outcomes (CLO):

1. *Able to explain and detail the application of management functions in managing business.*
2. *Able to determine alternative strategic actions that are most effective in certain business environment situations.*
3. *Able to explain roles and determine how human resources and physical resources are managed in a company.*
4. *Able to describe marketing concepts and marketing strategies.*
5. *Able to evaluate and discuss HR management cases, business strategy, marketing, and the company's environment.*

TPO61031	BASIC OF BIOTECHNOLOGY	2 CREDITS (2-0)

This course discusses knowledge including: genetic material, vector cloning, restriction assurance, recombinant DNA technology, introduction to molecular methods for DNA amplification, polymerase chain reaction, DNA synthesis, DNA sequencing, genetic manipulation, mutagenesis, expression optimization, repair of microbial strains. Genetically modified products (bioplastics, polymers, biodiesel, and pharmaceuticals), Bioprocesses (renewable fuels: ethanol, methanol, biogas; organic acids)..

Course Learning Outcomes (CLO):

1. *Able to explain and discuss definitions of genes, genomes, microorganism cell structure, DNA, and RNA.*
2. *Able to formulate, demonstrate, and demonstrate genetic engineering history, a type of genetic engineering consisting of mutations, cloning and others.*
3. *Able to explain and re-apply plant biotechnology related to the definition and history of plant biotechnology, transgenic plants, and transgenic plant applications.*
4. *Able to analyze and evaluate biotechnology in health, namely*

detecting and diagnosing human diseases, medical products using biotecchnology and gene therapy.

TPO62032	DESIGN OF BIOPROCESS REACTOR	3 CREDITS (3-0)
This course is one of the top courses that discuss the notion of bioprocess reactor design, microorganisms, bioreactor equilibrium, yield, design equations, heat and mass transfer in bioreactors, fluid dynamics in bioreactors, bioreactor configuration, bioreactor construction, monitoring and control of bioreactors, ideal reactor operation, sterilization, scale-up of the bioreactor, development of new reactors. Prerequisite: TPO62015, TPO62021		
Course Learning Outcomes (CLO): 1. *Able to elaborate knowledge about mathematics and natural science materials to plan bioreactors.* 2. *Able to formulate and operate the process of converting biomass materials into high value derivative products.* 3. *Able to design a bioreactor and master biochemical reactions which include: control of material / material requirements and criteria, process mechanisms, instrumentation, process control.* 4. *Able to communicate and collaborate with various multidisciplinary groups in developing bioreactor designs.* 5. *Able to evaluate and assess the performance of a bioreactor as a whole (economic, technical, social).*		

TPO62033	PRACTICAL OF BIOPROCESS REACTOR DESIGN	1 CREDITS (0-1)
The course studies elaborate knowledge about mathematics and natural science materials to plan bioreactors and create it, which include: control of material/material requirements and criteria, process mechanisms, instrumentation, process control. ***Course Learning Outcomes (CLO):*** 1. *Able to design a bioreactor and master biochemical reactions, which include: control of material/material requirements and criteria, process mechanisms, instrumentation, process control.* 2. *Able to communicate and collaborate with various multidisciplinary groups in developing bioreactor designs.* 3. *Able to evaluate and assess a bioreactor's performance as a*		

whole (economic, technical, social).

TPO62034	INDUSTRIAL BIOPROCESS MANUFACTURING	3 CREDITS (3-0)

This course is one of the top courses, where students must be able to elaborate on all the courses that have been obtained to design a Bioprocess Industry. The courses in question are courses that contain soft skills, Economics and Management, and Technical, which include planning, testing, and evaluation. Lecture materials include: Professional Ethical Values and Law in Industrial Planning (understanding of ISO, Law, Regulation, etc.), Natural Resources Analysis (raw materials), Market Analysis, Business Feasibility Planning, Planning for Human Resources and Financial Needs, Themes regarding types of non-food food products or commodities for case studies, factory layout planning, complete planning and analysis of operational unit needs, evaluation planning, maintenance planning, dynamic operation simulations, large tasks of bioprocess industrial planning with output in the form of technical drawings and feasibility documents effort.

Course Learning Outcomes (CLO):

1. *Able to design a processing system.*
2. *Able to analyze capacity requirements, machines, utilities, mass and energy balances in bioprocess-based plant design.*
3. *Able to compile and discuss bioprocess industry design proposals.*

TPO62035	APPLICATION OF FERMENTATION TECHNOLOGY	3 CREDITS (3-0)

This course discusses the importance of fermentation in the industry. The principle of fermentation, types of fermentation. Biological materials/agents for the fermentation process, microorganisms in fermentation. Fermentation methods and techniques, substrate handling, starter, medium, and inoculation. Sterilization. Fermenter design and control, fermentation kinetics, process control, separation equipment in fermentation. Fermentation technology applications in industry (food, biomass, non-food).

Prerequisite: TPO61011

Course Learning Outcomes (CLO):

1. *Able to explain the definitions and principles of various fermentation technology applications in food and non-food.*
2. *Able to explain the basis of fermentation technology in food and non-food processing and its application.*
3. *Able to analyze and present research that produces fermentation-based food and non-food products (bioproducts) to solve problems related to Bioprocess engineering.*

TPO62036	MODELLING AND OPTIMATION OF BIOLOGICAL SYSTEMS	3 CREDITS (2-1)

This course provides knowledge and an introduction to the application of the basics of modeling so that students have an understanding of how to make models from translating biological systems to mathematical equations, application of basic engineering principles through flowchart making to mathematical equations then solving these equations and simulating in a computer program.

Prerequisite: TPO62007.

Course Learning Outcomes (CLO):

1. *Able to elaborate various scientific disciplines in solving biological systems.*
2. *Able to compile a bioconversion process algorithm and describe it in the form of a mathematical model.*
3. *Able to complete the model into a response function, both analytically and iteratively.*
4. *Able to show the accuracy and accuracy of the model by performing simulations.*

TPO62037	BIOENERGY ENGINEERING	2 CREDITS (2-0)

Bioenergy engineering courses provide an understanding of biomass-based energy. Including knowledge about introduction and bioenergy material. World and national energy needs and energy availability, energy planning and human needs, energy sources and energy needs in the future. Energy from biomass sources, biomass utilization benefits, energy conversion from biomass through direct combustion, pyrolysis, fermentation, anaerobic digestion, esterification, and transesterification.

Course Learning Outcomes (CLO):

1. *Able to make products variation.*
2. *Able to arrange operational process map, assembly map, routing sheet, multiple product process chart, organizational structure and workforce plan, floor area calculation, from-to chart of material handling cost, inflow-outflow map, and priority scale, activity relationship diagram and area allocation diagram.*

TPO61038	MEMBRANE TECHNOLOGY AND PROCESSES	2 CREDITS (2-0)

This course provides an explanation of the basics of membrane technology, the principles of separation with membranes, membrane preparation made from ceramics, metals and polymers, characterization of membrane materials, membrane processes and systems, membrane applications for food processing (fruit industry, milk and its derivatives.), supply of drinking water and purification of waste and by-products. Membrane applications in the bioprocess field.

Prerequisite: TPO61023

Course Learning Outcomes (CLO):

1. *Able to explain and discuss membrane definitions, basic terms in membrane processes, and types of membrane processes.*
2. *Able to explain and discuss membrane synthesis methods and their characterization.*
3. *Able to explain and apply membrane technology and processes in the bioprocess field.*
4. *Able to formulate, demonstrate and demonstrate methods of synthesis and membrane characterization.*

TPO61039	PRACTICAL OF MEMBRANE TECHNOLOGY AND PROCESSES	1 CREDITS (0-1)

This course provides practice of measuring basic quantities/parameters in membrane processes such as flux, rejection, manufacture of polymer membranes and basic characterization of membrane materials.

Prerequisite: TPO61023

Course Learning Outcomes (CLO):

1. *Students are able to make a production plan which starting from determining the location, determining the production capacity, composing demand forecasting, and making the aggregate plan*

2. *Students are able to handle deterministic and probabilistic inventory control.*
3. *Students are able to make material requirements planning.*

TPO61040	COMPUTATIONAL FLUID DYNAMICS	3 CREDITS (2-1)

This course explains the basics of CFD, Navier-Stokes equations, mathematical models and boundary conditions, mesh and grid generation, discretization (Finite Element Methods, Finite Difference Methods, and Finite Volume Methods), introduction to CFD software.

Prerequisite: TPO61008

Course Learning Outcomes (CLO):

1. *Able to explain the definition of basic principles of fluid dynamics and their computations.*
2. *Able to explain fluid dynamics computational procedures and some mathematical model approaches used.*
3. *Able to analyze and present the results of fluid dynamics computational analysis about problems in the field of bioprocess engineering.*

TPO61041	INDUSTRIAL WASTEWATER TREATMENT	2 CREDITS (2-0)

This course explains the principles of industrial wastewater treatment, covering the basics of physical waste treatment (filtration, sedimentation), chemistry (flocculation, coagulation), biology (activated sludge), the use of advanced technology in waste treatment (MBR, IFASS etc.), application of control and optimization in waste treatment. Characterization of liquid waste and its treatment standards; Dissolved, organic and inorganic pollutants; Colloids and oil emulsions; BOD, COD and TOC; Organic degradation by aerobic systems and activated sludge; Bioreactors and aeration systems; Aerobic treatment with a biofilm system; Anaerobic degradation; Biodegradation of certain organic compounds; Nitrification, denitrification and phosphorus separation; Integrated waste treatment.

Course Learning Outcomes (CLO):

1. *Able to understand and explain the quality of clean water for industry and sources of water pollutants in the industrial world.*
2. *Able to understand and explain the principles of industrial wastewater treatment and its operating units in physics, biology, chemistry, and advanced technology in industrial wastewater treatment.*
3. *Able to analyze and present the selection of bioprocess industrial wastewater treatment units.*

TPO61042	**HERBS TECHNOLOGY**	**2 CREDITS (2-0)**

This course includes an introduction to: Introduction, development, and use of natural ingredients (herbs) as medicinal ingredients. Diversity of herbal medicinal ingredients and their active ingredients. Identification and characterization of the physical, chemical, and biological properties of herbal ingredients. Herbal remedies and preparations. Capsule formulations for herbal medicinal preparations. Introduction of separation (extraction) and purification (isolation) techniques of active herbal ingredients, Mixing preparation technology and testing the efficacy of herbal ingredients and their toxicology. Drug preparation formulations. Case studies: current issues related to herbal medicines.

Course Learning Outcomes (CLO):

1. *Students are able to have an insight into the application of Bioprocess engineering in herbal processing.*
2. *Students are able to analyze herbal ingredients and their pharmacological benefits.*
3. *Students are able to explain the formulation of medicinal preparations from herbal ingredients.*
4. *Students have skills in the design of bioproduct conversion based on herbal ingredients.*

TPO61043	**CALIBRATION IN ENGINEERING**	**2 CREDITS (2-0)**

This course provides knowledge and introduction to Measurement and Calibration, Mass Calibration, Temperature Calibration, Volume Calibration, Electrical Calibration, Dimensional Calibration.

Course Learning Outcomes (CLO):

1. *Able to explain the concept of performing calibration.*
2. *Able to explain, make diagrams, calculate the uncertainty value of a calibration.*
3. *Able to explain, make calibration procedures.*
4. *Able to explain, make and issue calibration certificates.*

TPO61044	PRACTICAL OF CALIBRATION IN ENGINEERING	1 CREDITS (0-1)

This course provides basic practice of measuring and calibrating various quantities of mass, temperature, volume, and electricity.

Course Learning Outcomes (CLO):

1. *Able to make diagrams, calculate the uncertainty value of a calibration.*
2. *Able to apply calibration procedures.*

TPO62045	ADVANCED PROGRAMMING	2 CREDITS (2-0)

This course explains the Matlab program and its similar programs and its benefits and introduction to Matlab, basic computer programming, variables and constants, operators, formulas and functions, Matlab toolboxes. Introduction to Matlab work environment, signs and variables, working with workspaces, storing and retrieving data, examples of simple math problems. General rules in Matlab (variables and operators), introduction to help Matlab. Review of Linear Algebra, Arrays and Matrices, Polynomials. Computer programming. Matlab programming. Variable string, M-File script. Relations, Logic, and program control. Data analysis (std deviation, mean, etc.), interpolation. Making the M-File function. 2D and 3D visualization. Read and write data, graphic layouts, and scripts. Standard algebraic operations, differential and integral, search with Solve. Introduction to GUI and Simulink. Numerical simulation. Prerequisite: TPO62005.

Course Learning Outcomes (CLO):

1. *Able to comprehend the concept of industrial project planning and the strategies in estimating the project.*
2. *Able to analyze industrial management aspects in sustainable agroindustry project planning.*

TPO62046	NON THERMAL PROCESSING TECHNOLOGY	2 CREDITS (2-0)

The Non-Thermal Processing Technology course explain non-thermal processing techniques for agricultural materials, especially for food. The non-thermal techniques described in this course include: 1. Physical processes such as High-Pressure Processing (HHP), 2. Electromagnetic processes such as Pulsed Electric Field (PEF), 2. Irradiation and UV treatment, 3. ozone treatment, 4. treatment by gas phase of chlorine dioxide etc. 5. Combination with thermal or non-thermal technology, 6. commercialization of this technology.

Course Learning Outcomes (CLO):

1. *Able to understand and explain types of non-thermal processing, general comparison with thermal processing technology.*
2. *Able to explain, assemble, and calculate with physical processing techniques.*
3. *Able to explain, assemble, and calculate with processing techniques using electromagnetic processes.*
4. *Able to explain, make designs and discuss non-thermal technology combinations.*

DEPARTMENT OF AGROINDUSTRIAL ENGINEERING

1) The Bachelor of Agroindustrial Engineering

Course Syllabus of Agroindustrial Engineering Study Program

TPI61001	ORGANIC AND INORGANIC CHEMISTRY	2 CREDITS (2-0)

This course contains introductory chemistry based on inorganic and organic compounds. Inorganic chemistry deals with the structural aspects of chemical compounds, mole concept, chemical calculations, and the analysis of inorganic compounds reaction. Meanwhile, organic chemistry discusses aspects of aliphatic compounds and several functional groups and the organic compounds drawing of a chemical reaction.

Course Learning Outcomes (CLO):

1. *Able to explain chemical structure, mole concept, chemical calculations, and analysis of inorganic compound reactions*
2. *Able to explain aliphatic compounds, functional groups and organic compounds*

3.	*Able to demonstrate and interpret experimental laboratory data based on inorganic and organic compounds*

TPI61002	ORGANIC AND INORGANIC CHEMISTRY LAB WORK	1 CREDITS (0-1)
The course provides students learning to carry out practice of introduction to tools and occupational safety and health procedure, preparation and dilution of solutions and buffer solutions, volumetric analysis, spectrophotometry, identification of alcohol, aldehyde and ketone functional groups, saponification reactions and qualitative tests of protein.		
Course Learning Outcomes (CLO): 1. *Able to demonstrate and interpret laboratory experimental data based on organic and inorganic compounds.*		

TPI61003	BIOLOGY	2 CREDITS (2-0)
The course contains an introduction to the concept and scope of biology, including an introduction to biological molecules that compose the body of organisms, the cell structure of prokaryotic and eukaryotic organisms, molecular genetics and inheritance process, biotechnology study, and studies on the classification of organisms that will specifically discuss organisms of the group of viruses, bacteria, archaea, fungi, plants, and animals from the group vertebrates and invertebrates. The introduction of basic biology will also be supported by applying biological sciences in the environmental and industrial fields, particularly agroindustry. ***Course Learning Outcomes (CLO):*** 1. *Able to explain the structure of the organism, the biological process occurred in the body of organism and classification of organism.* 2. *Able to elaborate the use of organisms in the environmental and industrial fields, especially agroindustry.*		

TPI61004	BIOLOGY LAB WORK	1 credit (0-1)
This course contains the introduction to tools and materials, as well as practice on the concept and scope of biological science, including the cell structure of prokaryotic and eukaryotic organisms, viruses, bacteria, archaea, fungi, plants, and animals of the vertebrates and invertebrates groups associated with its applications in agroindustry.		

Course Learning Outcomes (CLO):

1. *Able to identify tools and materials used in the analysis of organism cells*
2. *Able to show cell structure of organism*
3. *Able to differentiate between growth mechanism of bacteria, fungi, plants and animals.*
4. *Able to identify organism that contributes significantly to agroindustry.*

TPI61005	INTRODUCTION TO AGROINDUSTRY	2 CREDITS (2-0)

This course is a basic course that introduces the principles and concepts of Agroindustrial Engineering study including its scope, challenges and prospects, the role and importance of Engineering Management, Process Engineering and Systems Engineering.

Course Learning Outcomes (CLO):

1. *Able to characterize industries which belong to Agroindustrial groups.*
2. *Able to elaborate the roles of process engineering of agroindustry*
3. *Able to elaborate the roles of industrial management of agroindustry*
4. *Able to elaborate the roles of system engineering of Agroindustry*

TPI61006	INTRODUCTION TO ECONOMICS	2 CREDITS (2-0)

The course deals with the concept and scope of development of economics, structure, manner, and performance and policy in making economic decisions, both micro and macro.

Course Learning Outcomes (CLO):

1. *Able to explain scope and policy for the economics development both micro and macro*
2. *Able to explain producer behavior (production theory, demand, elasticity, cost theory, behavior structure, and market performance)*
3. *Able to explain consumer behavior (consumption and utility theory, supply, elasticity and equilibrium)*

TPI61007	MATHEMATICS	2 CREDITS (2-0)

The course contains definition, determinant use and form, matrices and vectors, partial fractions, arithmetic sequences and series, geometry, Maclaurin and Binomials, function definitions, composition of functions,

types of functions, function graphs, and mathematical logic.
Course Learning Outcomes (CLO): *1. Able to describe the resolution of mathematical problems using determinants, matrices, and vectors.* *2. Able to change the math equation using partial fraction* *3. Able to demonstrate arithmetic progression and arithmetic sequence* *4. Able to categorize function and non-function* *5. Able to conclude problems into mathematical logic*

TPI61008	**DRAWING TECHNIQUES**	**2 CREDITS (2-0)**
The course contains introduction to the use of drawing tools, techniques to read drawing, projecting shape and basic rules in making engineering drawings for the benefit of the production process. ***Course Learning Outcomes (CLO):*** *1. Able to identify the use of drawing tools* *2. Able to explain principles of engineering drawing according to ISO standard* *3. Able to design engineering drawing* *4. Able to draw product design of Agroindustrial field*		

TPI61009	**DRAWING TECHNIQUES LAB WORK**	**1 CREDITS (0-1)**
The course contains introduction to the use of drawing tools, techniques to read drawing, projecting shape, and basic rules in making engineering drawings for the benefit of the production process both manually and by using AutoCAD. ***Course Learning Outcomes (CLO):*** *1. Able to identify the use of drawing tools* *2. Able to identify principles of engineering drawing according to ISO standard* *3. Able to prepare design of engineering drawing* *4. Able to show creation of engineering drawing*		

TPI62010	**CALCULUS**	**2 CREDITS (2-0)**

This course contains limits and continuity of functions, derivatives of functions and their applications, Laplace transforms, integrals and their applications, transcendent functions, conic and polar coordinates, and vector calculus. ***Course Learning Outcomes (CLO):*** *1. Able to calculate value of limit function value, definite value, line and surface integral* *2. Able to determine the continuity of a function of a point, n^{th} derivative and partial derivative of functions, the form of multiple integrals* *3. Able to apply derivatives and integral applications* *4. Able to identify the characteristics of the transcendent function* *5. Able to convert polar coordinates to conic coordinates and vice versa*

TPI62011	INDUSTRIAL MICROBIOLOGY	2 CREDITS (2-0)
The course contains the basic concepts of Industrial Microbiology, industrial microorganisms' characteristics, the growth of industrial microorganisms, fermentation media, influential factors during fermentation, the fermentation process, scale-up, and product purification, as well as opportunities and challenges of Industrial microbiology. ***Course Learning Outcomes (CLO):*** *1. Able to identify types of industrial microorganisms.* *2. Able to determine the types and number of raw materials to produce fermented products.* *3. Able to explain the basics of the fermentation process.*		

TPI62012	INDUSTRIAL MICROBIOLOGY LAB WORK	1 credit (0-1)
This course contains demonstrations of the use of analytical tools and materials and basic practices regarding characteristics of industrial microorganisms, the growth of industrial microorganisms in various fermentation media, the calculation of cell numbers and their growth kinetics, influence of factors and methods in fermentation.		

Course Learning Outcomes (CLO):

1. *Able to use tools and materials for analysis of industrial microbiology*
2. *Able to show various types of industrial microorganism*
3. *Able to complete bacterial calculation and growth kinetics*
4. *Able to show the impact of process factor on fermentation*
5. *Able to demonstrate fermentation methods both on liquid and solid substrates*

TPI62013	BASIC OF PROCESS ENGINEERING	2 CREDITS (2-0)

The course deals with basic engineering of physical and chemical processes and the design basis, type, and diagram of the agroindustrial processes.

Course Learning Outcomes (CLO):

1. *Able to calculate mathematically basic of physical and chemical processes of agroindustry*
2. *Able to explain basic of process design of agroindustry*

TPI62014	COMPUTER PROGRAMMING	2 CREDITS (2-0)

This course contains introduction to computers and the Python programming language. The materials discussed includes work environment, variables, data types and operator types, branching and looping, functions, list structures and introduction to objects and classes of Python.

Course Learning Outcomes (CLO):

1. *Able to identify variables and data types*
2. *Able to explain branching and looping*
3. *Able to illustrate the use of function of the program*
4. *Able to demonstrate list structures, tuple and dictionary*
5. *Able to construct simple program*

TPI62015	COMPUTER PROGRAMMING LAB WORK	1 credit (0-1)

The course contains an introduction to computers and Phyton language programming. Students will learn Phyton's work environment, variables, data types, and operator type in Phyton. Furthermore, they will practice branching and looping, use function, learn list structure, and identify

objects in Phyton. ***Course Learning Outcomes (CLO):*** 1. *Able to identify variables and data types.* 2. *Able to differentiate between branching and looping* 3. *Able to show the use of functions on the program* 4. *Able to choose list structure, tuple and dictionary* 5. *Able to practice simple program*		
TPI62016	**INDUSTRIAL WASTE AND ENVIRONMENTAL MANAGEMENT**	**2 CREDITS (2-0)**
This course contains the scope of industrial waste and environmental management, waste characteristics, waste and environmental laws and regulations, environmental management systems, basic of environmental performance improvement and its tools, and environmental impact assessment (TOR-EIA, Environmental Management Plan (EMP), Environmental Management Plan, Environmental Audit). ***Course Learning Outcomes (CLO):*** 1. *Able to explain concept and principle of industrial waste and environmental management* 2. *Able to apply EIA method and environmental audit to create sustainable agroindustry*		

TPI62017	**HUMAN RESOURCES MANAGEMENT**	**2 CREDITS (2-0)**
The course contains basic concept of human resource management, scope of work of 5's job (job analysis, job description, job specification, job design, job evaluation), as well as staffing process stages (HR planning, recruitment, selection, orientation, and placement, training and development, performance appraisal, compensation systems and career planning). ***Course Learning Outcomes (CLO):*** 1. *Able to apply the concept and process of human resource management as well as the scope of work of 5's job* 2. *Able to apply the procedures in staffing process of creative, sustainable agroindustrial business*		

TPI62018	AGROINDUSTRIAL MATERIALS SCIENCE	2 CREDITS (2-0)

The course discusses characteristics (physical, chemical and physiology properties), potential and productivity of agroindustrial raw materials (agriculture, plantation, forestry, husbandry and fisheries as well as fresh handling, post-harvest, physicochemical changes during the process and prospects for diversification of processed products.

Course Learning Outcomes (CLO):

1. *Able to identify characteristics and productivity of industrial raw materials*
2. *Able to identify diversification of processed products of agroindustrial raw materials*

TPI62019	AGROINDUSTRIAL MATERIALS SCIENCE LAB WORK	1 CREDITS (0-1)

The course provides students learning to carry out practice regarding introduction to laboratory tools and equipment, fresh handling of horticultural products, fats and oils, total sugar testing, caramelization, gelatinization, and dextrinization in tubers and cereals, fresheners and food additives.

Course Learning Outcomes (CLO):

1. *Able to carry out laboratory experiments regarding fresh materials handling and characteristics of agro-industrial raw materials.*

TPI61020	INDUSTRIAL MATHEMATICS	2 CREDITS (2-0)

The course deals with mathematical techniques and their application in solving problems in industry by mathematical model approach. Materials studied include methods and concept of interpolation, systems of equations, equation roots, numerical integrals, numerical differentials, various types of differential equations and systems of differential equations, analytical and numerical solutions, and their application in the industrial field.

Course Learning Outcomes (CLO):

1. *Able to apply interpolation techniques in seeking value of approach*
2. *Able to describe concept of system of mathematical equation*
3. *Able to apply numerical integrals and differentials in the agroindustrial field*

4. *Able to describe problems of industrial field by Differential Equation approach*
5. *Able to solve system of mathematical equations in the agroindustrial field by applying analytical and numerical methods*

TPI61021	UNIT OPERATIONS	2 CREDITS (2-0)

The course discusses theory and principles of unit operation of agroindustry as well as performance calculation and efficiency of each unit operation.

Course Learning Outcomes (CLO):

1. *Able to compare work principle of unit operation*
2. *Able to analyze mass balance, energy, and transport phenomena in agroindustrial unit operation.*
3. *Able to carry out experiments by various unit operations*

TPI61022	UNIT OPERATIONS LAB WORK	1 credit (0-1)

The course provides students learning to carry out practice regarding size reduction, mixing, drying, heating and cooling, evaporation and crystallization, adsorption, extraction and distillation.

Course Learning Outcomes (CLO):

1. *Able to carry out experiments by sundry unit operations*

TPI61023	INDUSTRIAL STATISTICS 1	2 CREDITS (2-0)

The course contains descriptive statistics, probability, discrete and continuous probability distributions, sampling techniques, parameter estimation, hypothesis testing, regression analysis, and linear and nonlinear correlation.

Course Learning Outcomes (CLO):

1. *Able to apply the concept of descriptive statistics*
2. *Able to use the concept of probability and probability distribution*
3. *Able to determine appropriate sampling techniques and parameter estimation*
4. *Able to determine exact hypothesis testing*
5. *Able to apply regression method and linear and nonlinear correlation on the agro-industrial problems*

TPI61024	INDUSTRIAL STATISTICS 1 LAB WORK	1 CREDITS (0-1)

The course contains exercises and demonstrations of descriptive statistics, probability, discrete and continuous probability distribution, sampling techniques, parameter estimation, hypothesis testing, data test validity and reliability, classical assumption test, regression analysis and linear and nonlinear correlation in agroindustrial field.

Course Learning Outcomes (CLO):

1. *Able to perform presentation of data, measures of central tendency and variability*
2. *Able to use the concept of probability and probability distribution*
3. *Able to organize appropriate sampling techniques and parameter estimations*
4. *Able to perform hypothesis testing*
5. *Able to operate regression analysis and linear and nonlinear correlation*

TPI61025	PRODUCT DESIGN AND DEVELOPMENT	2 CREDITS (2-0)

The course contains clear and detailed product development methods which its each stage involves marketing functions, design, and manufacture in a company. Moreover, the concept and application of product development are covered to identify and integrate customers' voice into its design as the basis of product development and create new products according to the market share.

Course Learning Outcomes (CLO):

1. *Able to convert idea into agroindustrial-based product concept*
2. *Able to organize agroindustrial product development process based on the quality or attributes desired by costumers*
3. *Able to design innovative and feasible agroindustrial products*

TPI61026	OPERATIONS RESEARCH	3 CREDITS (3-0)

The course discusses the definition of operation research and its basic concept, build linear programming model ad its solving, integer model, goal programming model, transportation and assignment problems, network model, CPM and PERT project scheduling problems as well as dynamic programming method.

Course Learning Outcomes (CLO):

1. *Able to identify elements of the mathematical model of a problem of complex agro-industrial system*
2. *Able to build a mathematical model of linear programming according to the identification result of model elements*
3. *Able to optimally allocate assignment and dispatch problems of transportation model*
4. *Able to apply network model to solve optimization problems*
5. *Able to create project scheduling*
6. *Able to apply dynamic programming methods*

TPI61027	WORK DESIGN AND ERGONOMICS	2 CREDITS (2-0)
The course contains work productivity and work study, method study, map work, direct and indirect work measurement, ergonomics basic concept, human machine system, workstation design and anthropometry, physiological work, workload, work environment and displays.		
Course Learning Outcomes (CLO): 1. *Able to clarify ergonomics basic concept, human machine system, physiological work, work environment and displays* 2. *Able to analyze using work study method, motion study, and anthropometry in designing safe and comfortable work system* 3. *Able to draw map work to design system components* 4. *Able to calculate using direct and indirect work measurement*		

TPI61028	WORK DESIGN AND ERGONOMICS LAB WORK	1 credit (0-1)
The course contains basic practice concepts of work productivity, work-study, method study and motion study, map work organization, direct work measurement, indirect work measurement, anthropometry measurement, workstation design, and a safe and comfortable work system ergonomic principles. ***Course Learning Outcomes (CLO):*** 1. *Able to draft map work* 2. *Able to carry out direct work measurement and anthropometry* 3. *Able to manage workstation and safe and comfortable work system according to ergonomic principles*		

TPI61029	WASTE TECHNOLOGY	2 CREDITS (2-0)

The course contains waste parameter and waste characterization methods, waste treatment methods, waste treatment of liquid, solid and gas waste (including pre-treatment, process, and post-treatment aspects), calculation and design of waste treatment system aerobic and anaerobic waste utilization, as well as techno-economic analysis of waste treatment systems.

Course Learning Outcomes (CLO):

1. *Able to explain waste treatment technology according to waste type and characteristics*
2. *Able to calculate needs and design aerobic and anaerobic waste treatment systems*

TPI61030	WASTE TECHNOLOGY LAB WORK	1 credit (0-1)

The course contains practice and demonstration of analyzer, parameter characterization of liquid and solid waste, application of liquid and solid waste treatment technology biologically and chemically.

Course Learning Outcomes (CLO):

1. *Able to use tools for liquid and solid waste characterization*
2. *Able to practice liquid and solid waste characterization*
3. *Able to operate the use of separator technology on liquid waste*
4. *Able to operate the use of composting and anaerobic digestion technology on solid waste*

TPI61031	QUALITY CONTROL	2 CREDITS (2-0)

The course includes basic concept of total quality management, quality assurance, quality design by using several different approaches (quality design process, customer-oriented design, quality function deployment and FMEA in process design, hygienic design concept and Taguchi method), as well as statistical principles application in quality control and calculation of quality costs in agroindustry.

Course Learning Outcomes (CLO):

1. *Able to understand and apply total quality management principles and statistical principles in quality control of agroindustry*
2. *Able to identify application of quality assurance in the local-based agroindustry*
3. *Able to analyze statistical data in the quality control process of agroindustry*

TPI62032	UNIT PROCESSES	2 CREDITS (2-0)

The course provides an understanding of agroindustry's chemical processes, including conversion and transformation of agricultural products, process design, process control and evaluation, scale multiplication, and integration of food and non-food based processes.

Course Learning Outcomes (CLO):

1. *Able to describe chemical processes of agroindustry*
2. *Able to create process blueprint of agroindustry*
3. *Able to analyze process integration of agroindustry*

TPI62033	OPTIMIZATION TECHNIQUES	2 CREDITS (2-0)

The course studies concept and scope of optimization technique, model, optimization formulation, unconstrained optimization for single and multi variable, nonlinear programming, geometric programming, and the development of the latest methods of optimization.

Course Learning Outcomes (CLO):

1. *Able to analyze optimization issues and formulation in agroindustrial system.*
2. *Able to solve optimization problems in agroindustrial field both for single and multi-variable in the constrained and unconstrained condition*
3. *Able to solve optimization problems in agroindustrial field by using nonlinear and geometry method*
4. *Able to apply global optimization model in agroindustrial field for discrete and continuous variable*

TPI62034	BIOPROCESS ENGINEERING	2 CREDITS

		(2-0)

This course contains the basic concept of reaction rate, reaction kinetics, enzyme kinetics, enzyme deactivation, cell culture yield, growth kinetics, substrate kinetics, and cell death kinetics.

Course Learning Outcomes (CLO):

1. *Able to analyze growth and death kinetics of bioprocess*
2. *Able to determine the optimal condition of bioprocess*

TPI62035	**BIOPROCESS ENGINEERING LAB WORK**	**1 CREDITS (0-1)**

The course contains basic calculation of reaction rate, reaction kinetics, enzyme kinetics, enzyme deactivation, cell culture yield, growth kinetics, substrate kinetics and cell death kinetics.

Course Learning Outcomes (CLO):

1. *Able to calculate growth and death kinetics of bioprocess*
2. *Able to determine optimal condition of bioprocess*

TPI62036	**PLANT LAYOUT AND MATERIAL HANDLING**	**2 CREDITS (2-0)**

This course contains the study of the concept of material handling and facility layout planning, product and process designing, material flow designing, facility planning, inter-facility connection analysis, material-handling equipment, material handling cost, warehouse and supporting facilities, computer-based lay-outing and advanced modeling.

Course Learning Outcomes (CLO):

1. *Able to explain the basic concept of facility designing and material handling, factors, and stages in product and process designing.*
2. *Able to analyze material flow, inter-facility connection, and material handling cost.*
3. *Able to identify facility requirements, material-handling equipment, warehouse and supporting facilities.*
4. *Able to solve plant layout problems using computer-based layout and advanced modeling.*

TPI62037	**PLANT LAYOUT AND MATERIAL HANDLING LAB WORK**	**1 CREDITS (0-1)**

This course contains plant layout planning practice which covers product *designing, operational process mapping, assembly map, routing sheet, multiple product process chart, organizational structure and workforce planning, floor area calculation, from-to chart of material handling cost, inflow-outflow mapping, priority scale, activity relation diagram, activity relationship chart, activity relationship diagram, area allocation diagram, and overhead view perspective of facility layout and material flow in the production process.*

Course Learning Outcomes (CLO):

1. *Able to make products variation.*
2. *Able to arrange operational process map, assembly map, routing sheet, multiple product process chart, organizational structure and workforce plan, floor area calculation, from-to chart of material handling cost, inflow-outflow map, and priority scale, activity relationship diagram, and area allocation diagram.*
3. *Able to improve from-to chart of material handling cost, inflow-outflow map, and priority scale.*
4. *Able to sketch two-dimensional facility layout and material flow in-process production.*

TPI62038	PRODUCTION PLANNING AND INVENTORY CONTROL	2 CREDITS (2-0)

This course contains production management related to the problems in manufacturing systems both in qualitative and quantitative which covers the introduction of production planning and inventory control, location and capacity planning, demand forecasting, aggregate planning, master production scheduling, inventory control, material requirements planning, just in time and resource manufacture planning.

Course Learning Outcomes (CLO):

1. *Able to explain production plan concept and inventory control.*
2. *Able to analyze the location definition, capacity, demand, production, material requirements and manufacture resource to support creative agroindustry in a sustainable way.*

TPI62039	PRODUCTION PLANNING AND INVENTORY CONTROL LAB WORK	1 CREDITS (0-1)

This course contains the practice of location planning, capacity determination, demand forecasting, aggregate planning, inventory control and material requirements planning.

Course Learning Outcomes (CLO):

1. *Students are able to make production plan which starting from determining the location, determining the production capacity, composing demand forecasting and making the aggregate plan*
2. *Students are able to handle deterministic and probabilistic inventory control*
3. *Students are able to make material requirements planning*

TPI62040	SYSTEM MODELLING AND SIMULATION	3 CREDITS (3-0)

This course contains system and modeling concepts, model analysis and design, dynamical model and discrete system simulation, and current development of system modeling and simulation.

Course Learning Outcomes (CLO):

1. *Able to examine sustainable agroindustrial system by using system approach.*
2. *Able to identify system component.*
3. *Able to illustrate model in agroindustrial system.*
4. *Able to analyze problems in data-based agroindustrial system.*
5. *Able to demonstrate system simulation using computer-based application.*

TPI62041	INFORMATION SYSTEM AND TECHNOLOGY	2 CREDITS (2-0)

This course contains the basic concept of information system and technology, information system development and database.

Course Learning Outcomes (CLO):

1. *Able to deliver the concept of computerized information system.*
2. *Able to determine the requirements of information system in business process.*
3. *Able to create information system blueprint.*
4. *Able to identify database in compliance with the organizational necessity using DBMS.*
5. *Able to deliver the development of information system and technology utilization in agroindustrial sector.*

TPI62042	INFORMATION SYSTEM AND	1 CREDITS

	TECHNOLOGY LAB WORK	(0-1)
This course contains the practice of information system and database development that covers process modeling and DFD, ER-Model, SQL (DDl, DML, Query), normalization, interface design, and web-based database system. ***Course Learning Outcomes (CLO):*** *1. Students are able to build simple information systems.* *2. Students are able to use the database management system (DBMS).*		

TPI61043	DECISION ANALYSIS	2 CREDITS (2-0)
This course contains the study of the basic concept and types of decision problems, decision making process, conditions in decision making, decision tree, compound occurrence, information concept and value, utility theory, decision analysis model using compound occurrence and solution model (Analytical Hierarchy Process, Analytical Network Process, and Fuzzy Decision Making). ***Course Learning Outcomes (CLO):*** *1. Able to determine the decision making method depends on the conditions (under certain and uncertain condition, with and without risk condition, with and without information condition).* *2. Able to apply decision analysis model by using compound occurrence (Multi-Criteria Decision Analysis) which includes Analytical Hierarchy Process, Analytical Network Process and Fuzzy Decision Making in agroindustry decision making problems.* *3. Able to solve decision making problems in agroindustry.*		

TPI61044	PLANT DESIGN	2 CREDITS (2-0)
This course is the synthesis of the Department of Agroindustry Technology that aims to understand the theory and principles of plant design, identify and analyze aspects that determine the success in building an agroindustry plant, and integrate the technical design calculation in designing an environmental-oriented plant. ***Course Learning Outcomes (CLO):*** *1. Able to analyze the requirements of capacity, machine, utility, mass balance and energy in agro-based plant design.* *2. Able to make a diagram and processing maps that support agro-based plant design.*		

3.	*Able to identify responsive and environment-oriented agro-based plant along with the current development.*

TPI61045	INDUSTRIAL PROJECT PLANNING	2 CREDITS (2-0)

This course contains the concept and understanding of industrial project planning, the importance of industrial planning studies, the studies of new product development in industrial planning, marketing analysis and planning aspects, the studies of technical and technological aspects, production capacity planning, production technology, machine and material requirements planning, lay out, location determining, estimation strategy, human resources and organization management aspects, environmental aspects, legality aspects, financial aspects, investment and capital budgeting knowledge, project qualifications analysis and project scheduling (WBS, OBS, Gantt Chart and CPM-PERT).

Course Learning Outcomes (CLO):

1. *Able to comprehend the concept of industrial project planning and the strategies in estimating the project.*
2. *Able to analyze industrial management aspects in sustainable agroindustry project planning.*
3. *Able to analyze the eligibility in constructing agroindustry project planning based on the technical, environmental, law and financial aspect.*

TPI61046	INDUSTRIAL STATISTIC 2	2 CREDITS (2-0)

This course contains Normality and Homogeneity Test, Completely Randomized Design (CRD) and Randomized Block Design (RBD), Factorial Design, Nested Design and Split Plot Design, Multiple Comparison, Orthogonal Comparison, Non-parametric Statistics, Factor Analysis, Basic Cluster Analysis, Multi-Dimensional Scaling Analysis, Discriminant Analysis, Conjoint Analysis and SEM-PLS-GSCA.

Course Learning Outcomes (CLO):

1. *Able to resolve problems in agroindustry by using appropriate sample design*
2. *Able to examine problem solving in parametric and non-parametric statistics*
3. *Able to analyze problems in agroindustry using multiple and orthogonal comparisons*
4. *Able to solve problems in agroindustry by using appropriate multivariate analysis*

TPI61047	AGROINDUSTRIAL PROJECT	2 CREDITS (2-0)

This course is the synthesis of Agroindustrial Engineering science to plan agroindustry project or business and to design its unit processing. The activities performed are including analyzing market potential; product concept; production process designing; raw material management; machine, equipment and utility designing; facility location and layout; work and sanitation safety; organizational and legal juridical management; waste and Environmental impact assessment (AMDAL) management; financial eligibility analysis and project scheduling.

Course Learning Outcomes (CLO):

1. *Able to analyze market potential, raw material, legal juridical, and financial-economic eligibility.*
2. *Able to design product concepts to develop as a business opportunity in agroindustry.*
3. *Able to design agroindustry unit processing (production, machine, equipment, and utility process).*
4. *Able to plan raw material management, facility location and layout, work and sanitation safety, organization management, legal, juridical, waste, and Environmental impact assessment (AMDAL) management.*
5. *Able to organize industrial project scheduling and able to work in a team to arrange business establishment proposals.*

TPI61048	SUPPLY CHAIN MANAGEMENT	2 CREDITS (2-0)

This course contains the basic concept of supply chain management, supply chain performance, activator and matrix in supply chain, distribution and network channel design, stock management, procurement management, transportation and distribution management, supply chain performance management, information distortion and bullwhip effect. ***Course Learning Outcomes (CLO):*** *1. Able to explain the concept of supply chain, scope and strategy achievement in sustainable agroindustry.* *2. Able to analyze the activator and matrix, information distortion and bullwhip effect in supply chain.* *3. Able to plan distribution, network, transportation, stock and procurement channels in supply chain.* *4. Able to demonstrate performance measurement in supply chain.*

TPI61049	**ANALYSIS AND EVALUATION OF AGROINDUSTRIAL PRODUCTS**	**1 CREDITS (1-0)**
This course discusses the principles of analysis and evaluation of agroindustry product, product analysis method (physical, chemical, microbiological and organoleptic), product analysis method (conventional and non-destructive), and quality evaluation of agroindustry product. ***Course Learning Outcomes (CLO):*** *1. Students are able to evaluate agroindustry products physically, chemically, microbiologically, and organoleptically.* *2. Students are able to explain the importance of analysis and evaluation of agroindustry products in technopreneurship development.*		

TPI61050	**ANALYSIS AND EVALUATION OF AGROINDUSTRIAL PRODUCTS LAB WORK**	**1 CREDITS (0-1)**
This course provides the students learning to perform the lab work on method analysis, product analysis (physical, chemical, microbiological and organoleptic), product analysis method (conventional and non-destructive) and quality evaluation of agroindustry product. ***Course Learning Outcomes (CLO):*** *1. Students are able to evaluate agroindustry products physically, chemically, microbiologically and organoleptically.*		

TPI61051	RISK MANAGEMENT	2 CREDITS (2-0)
This course contains certain concept and understanding of risk management, risk management standard, risk identification and classification, risk assessment, risk mitigation, risk control technique, risk insurance and transfer, and risk management in a variety of aspects such as: operational, human resources, marketing, supply chain, finance and environmental damage. ***Course Learning Outcomes (CLO):*** *1. Able to classify a variety of risk event faced by agroindustry business unit based on various risk criteria* *2. Able to prioritize any risk based on the analysis result of risk assessment* *3. Able to select an appropriate risk control technique based on the event, impact, and risk causes.* *4. Able to apply risk management in various aspects of agroindustry.*		

TPI61052	INDUSTRIAL PSYCHOLOGY	2 CREDITS (2-0)
This course contains the concept of human behavior in organization, human basic attribute, perception, learning process and learning theory models, organizational behavior modification, work motivation and motivation theories, group dynamics, communication, conflict management, work stress, and productivity strategies. ***Course Learning Outcomes (CLO):*** *1. Able to analyze human behavior in work settings* *2. Able to diagnose problems related to human resources in the organization* *3. Able to examine labor performances in the organization*		

TPI61053	MAINTENANCE SYSTEM	2 CREDITS (2-0)
This course contains the definition of maintenance system, its connection with production system, performance in agroindustry production system, factors affecting facility, machine, production tools performances, preparation of cost requirements and submission on maintenance budget, reliability and maintainability, mathematical model of maintenance (preventive and corrective), preparation of preventive and corrective		

maintenance programs (inspection, repair, replacement, overhaul), performance measurements on the maintenance program and total productive maintenance (TPM). ***Course Learning Outcomes (CLO):*** *1. Able to outline the financial and budget requirements on the maintenance of the production facility system.* *2. Able to analyze certain problems in the facility system's reliability arranged in series, parallel, and hybrid.* *3. Able to select maintenance policy programs, both preventive and corrective, includes the inspection, repair, and replacement of agroindustrythe facility.* *4. Able to solve the problems on the effectiveness of production process facility using OEE, OTE, OPE.*

TPI61054	**DATA MINING**	**2 CREDITS (2-0)**
This course contains the data, processing techniques and data mining which includes classification, association and clusterization to acquire data patterns and important information as the fundamentals of decision-making process. ***Course Learning Outcomes (CLO):*** *1. Able to analyze data.* *2. Able to mine data.* *3. Able to examine data.* *4. Able to select data mining algorithm to solve individual and team problems.*		

TPI61055	**PROCESS ENGINEERING OF OIL, EMULSION AND OLEO CHEMICALS**	**2 CREDITS (2-0)**
This course discusses the characteristics of oil/emulsion/oleochemicals, extraction technique and method, oil refining and processing, basic and derivative emulsion and oleochemicals, oil product applications, basic emulsion and oleochemical (glycerol, methyl, ester, fatty acid, fatty alcohol) and its derivatives in agroindustry. ***Course Learning Outcomes (CLO):*** *1. Able to examine the characteristics of oil, emulsion, and oleochemical.* *2. Able to apply the techniques and method of extraction, oil refining*		

and processing, emulsion, and oleochemical.

3. *Able to analyze secondary data from the research related to oil, emulsion, and oleo chemical engineering.*

TPI61056	AUDIT OF AGROINDUSTRY	2 CREDITS (2-0)

This course discusses about the institutions in quality assurance system in Indonesia, audit process and guidance, types of audit system in agroindustry (halal quality system, Good Manufacturing Practices/GMP audit, Hazard Analytical Critical Control Point/HACCP audit, product certification, Halal Assurance System/HAS, Indonesia Sustainable Palm Oil/ISPO) and international quality assurance system (ISO 9001, ISO 22000, British Retail Consortium, Roundtable Sustainable Palm Oil/RSPO).

Course Learning Outcomes (CLO):

1. *Students are able to evaluate quality assurance system and audit process in agroindustrial sector.*
2. *Students are able to examine current issues and newest standard in quality assurance system.*

TPI61057	BIOREMEDIATION	2 CREDITS (2-0)

This course contains a discussion of bioremediation basics, types of hazardous pollution and toxicity level in the environment, the microorganism and enzyme that play a role in bioremediation and biotransformation process in bioremediation, phytoremediation, in situ and ex-situ bioremediation, as well as bioremediation application in agroindustrial waste.

Course Learning Outcomes (CLO):

1. *Able to characterize a variety of hazardous agroindustry pollution, types of microorganisms, and transformation in bioremediation.*
2. *Able to analyze the bioremediation process approach that can be used to solve environmental problems related to agroindustry.*
3. *Able to analyze secondary data from bioremediation implementation research in agroindustrial environment and waste.*

TPI61058	ENZYME AND MICROBIAL TECHNOLOGY	2 CREDITS (2-0)

This course discusses about enzyme (classification, production, mobilization, utilization and safety), microbes (fungal fermentation technology, yeast and bacteria) and microbes cells production. ***Course Learning Outcomes (CLO):*** 1. *Able to examine any important factors found in bioprocess enzymatically and/or microbially.* 2. *Able to analyze bioprocess involving enzyme and/or microbes.*

TPI62059	PACKAGING TECHNOLOGY	2 CREDITS (2-0)
This course explains the basic and technology in packaging, types, classification and characteristics of packaging materials, deviation of food quality and food safety (packaging durability), labeling and packing regulation, packaging design, analysis and evaluation of packing result product and its application in agroindustry. ***Course Learning Outcomes (CLO):*** 1. *Able to identify the types, classification, characteristics and durability of packaging material as basic packing.* 2. *Able to apply packing techniques and designs.* 3. *Able to create packaging blueprint based on the appropriate principles, techniques, labeling, and packing process regulation.*		

TPI62060	INDUSTRIAL MACHINERY AND INSTRUMENTATION	2 CREDITS (2-0)
This course discusses the basic principles, performances, characteristics, machine and tools functional evaluation, and supporting instruments in the agroindustry. ***Course Learning Outcomes (CLO):*** 1. *Able to explain the basic principles and characteristics of machines and tools in agroindustry.* 2. *Able to analyze performances of machine and tools components in agroindustry.* 3. *Able to identify types and variety of machines and tools in agroindustry.*		

TPI62061	OCCUPATIONAL SAFETY AND INDUSTRIAL ENVIRONMENT	2 CREDITS (2-0)
This course contains some concepts and principles in Occupational Safety		

and Health (K3), K3 management system, contaminant sources and its prevention, sanitation of production spaces and environment, and some improvement in production spaces zone.

Course Learning Outcomes (CLO):

1. *Able to identify K3 and industrial sanitation in the workplace.*
2. *Able to analyze the Management System of work safety and sanitation implementation in industrial products and processes.*
3. *Able to perform the professionalism principles and ethics in K3 and industrial sanitation.*

TPI62062	**SMART AGROINDUSTRY ***	**1 CREDITS (1-0)**

This course contains the introduction and development of industrial revolution, smart manufacturing and factories, smart agroindustry, Internet of Things (IoT) and its application in agroindustry.

Course Learning Outcomes((CLO):

1. *Able to make IoT blueprint in agroindustry sector.*
2. *Able to explain the Iot utilization development in agroindustry sector.*

TPI62063	**SPECIAL TOPIC OF AGROINDUSTRY**	**1 credit (1-0)**

This course contains the current agroindustry issues that in-include the evolution of agroindustry 4.0, current development in the smart and sustainable agroindustry sector, opportunities, and challenges agroindustry (such as process manipulation, management manipulation, system, bioindustry, and environment manipulation).

Course Learning Outcomes (CLO):

1. *Able to analyze current development in smart and sustainable agroindustry.*
2. *Able to examine current issues in smart and sustainable agroindustry.*

TPI62064	**COST ACCOUNTING**	**2 CREDITS (2-0)**

This course contains basic concept of accounting, cost behavior, cost calculation and accumulation, raw material cost, workforce cost, plant overhead cost, activity-based costing and activity based management), job order costing, just in time and backflushing, process-based costing *calculation, quality cost, production losses, side product and combination product.*

Course Learning Outcome (CLO):

1. *Able to calculate any cost used in the production process, including raw material cost, workforce/labor cost and plant overhead cost*
2. *Able to accumulate activity-based costing, in accordance with job order costing and process costing*
3. *Able to implement cost calculation in terms of creative-sustainable agroindustrial business*

TPI62065	**PRODUCTIVITY ANALYSIS**	**2 CREDITS (2-0)**

This elective course covers productivity concepts, a variety of productivity measurement methods at various levels, several methods on productivity measurement, TPM, OMAX, MFPMM, Balance Scorecard, Model Performance Prism, Integrated performance measurement system, Green productivity, and productivity evaluation and improvement plan.

Course Learning Outcomes (CLO):

1. *Able to analyze (C4) productivity in the company level*
2. *Able to apply (C3) productivity model used to measure productivity*
3. *Able to plan (C3) proposed productivity improvement action*

TPI62066	**ADVANCED OPERATION RESEARCH**	**2 CREDITS (2-0)**

This course in mainly associated with the implementation of quantitative techniques in problem solving by using mathematic model as the analysis tool, which encompasses Data Envelopment Analysis, Markov Chain, Queue, Game theory and Montecarlo.

Course Learning Outcomes (CLO):

1. *Able to analyze specific unit performance by using Data Envelopment Analysis method*
2. *Able to analyze some problems in queue system*
3. *Able to apply the concept of Markov chain*
4. *Able to select the optimal strategy by using Game Theory concept*

TPI62067	**INTELLIGENT SYSTEM**	**2 CREDITS (2-0)**

This course provides an introduction and expert system concepts, fuzzy *logic, artificial neural network, and genetic algorithm. In the learning process, several examples of the resolution around the issues related to the method used are given.*

Course Learning Outcomes (CLO):

1. *Able to establish specific expert system*
2. *Able to implement the concept of fuzzy logic*
3. *Able to arrange basic type of simple artificial neural network architecture*
4. *Able to select the best individual by using the concept of genetic algorithm*
5. *Able to implement the intelligent system concerning the latest issues*

TPI62068	PROCESS ENGINEERING OF ESSENTIAL OIL AND BIOPHARMACEUTICALS PRODUCTS	2 CREDITS (2-0)

This course discusses the source and the characteristic of raw material, extraction technique, function, analysis and testing technique as well as the development technique of the essential oil and biopharmaceuticals products.

Course Learning Outcomes (CLO):

1. *Able to classify the source and the characteristic of agroindustrial commodity as essential oil and biopharmaceuticals*
2. *Able to identify the extraction technique, analysis, testing and the development process of essential oil and biopharmaceuticals products.*
3. *Able to analyze the secondary data that resulted from the research on the component and quality of essential oil and biopharmaceutical products.*

TPI62069	PROCESS ENGINEERING OF PLANTATION AND FORESTRY PRODUCTS	2 CREDITS (2-0)

This research covers the process engineering of plantation commodities (coffee, cacao, tea, sugarcane and palm) and forestry commodities (wood and non-wood), more specifically in the main process parameter that impacts the quality and quantity of the functional component.

Course Learning Outcomes (CLO):

1. *Able to define any critical point in the most significant process towards product quality*

2. *Able to analyze the optimal condition to produce high-quality product*

TPI62070	CLEANER PRODUCTION	2 CREDITS (2-0)

This course contains some concepts on cleaner production in the sustainable agroindustry, cleaner production principle, some techniques and implementation of cleaner production, cleaner production management system, cleaner production assessment, design for environment, producer responsibility and also the case study regarding cleaner productions in the agroindustry sector.

Course Learning Outcomes (CLO):

1. *Able to explain the concept and principles of cleaner production to develop sustainable agroindustry*
2. *Able to implement cleaner production technique, management system and assessment*
3. *Able to demonstrate the concept of design for environment and producer responsibility to build sustainable agroindustry*
4. *Able to classify some issues in developing sustainable agroindustry*

TPI62071	BIOENERGY	2 CREDITS (2-0)

This course contains some basic concepts of bioenergy, bioenergy policy, classification and pre-treatment of biomass for bioenergy, bioenergy conversion technology (biological, chemical ad thermal), the concept of biorefinery, the analysis of bioenergy system, the concept of economy and the concept of bioenergy and biorefinery-based business development in small and large scale.

Course Learning Outcomes (CLO):

1. *Able to describe bioenergy types and national and international bioenergy policy*
2. *Able to characterize raw material/biomass types, pre-treatment process and conversion technology for bioenergy production and biorefinery development*
3. *Able to clarify several types and concepts of biorefinery and bio-economy*
4. *Able to apply technical, economic, and sustainable analysis procedure to develop bioenergy and biorefinery-based business*

TPI62072	FIELD STUDY	1 credit (0-1)
This course contains an introduction to agroindustry, industrial visit, the analysis of observation results related to management aspects, agro-industrial system and technology, and a presentation on field study visits. ***Course Learning Outcomes (CLO):*** 1. *Able to compare the theories of agroindustrial system, management, and technology and their application in the agroindustry companies* 2. *Able to collaborate in analyzing the observation results on the application of agroindustrial system, management, and technology* 3. *Able to deliver the observation result both verbally and in writing* 4. *Able to put professional ethics into practice when performing industrial visit*		

5.2. SYLLABUS OF MASTER PROGRAM

5.2.1. DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY

The Master of Agricultural Product Technology

TPP81001	RESEARCH METHODOLOGY AND STATISTICS IN AGRICULTURAL PRODUCT TECHNOLOGY	3 CREDITS (3-0)
Students are expected to be able to formulate research proposal concepts within the scope of the Agricultural Product Technology area. The main topics consist of scientific research methodology starting from issues identification and formulation, literature review, variable identification, observation and data collection, data analysis and its interpretation, as		

well as writing report and scientific publication.

TPP81002	ADVANCED FOOD ANALYSIS	3 CREDITS (3-0)
Students are expected to be able to operate food laboratary instruments. The course materials consist of food structure, food characteristics due to processing process, food analysis principals techniques including chemical reaction involved and advanced instruments used in food analysis.		
TPP81003	**FOOD NUTRITION EVALUATION TECHNIQUES**	**2 CREDITS (2-0)**
This course covers the evaluation of nutrient and non-nutrient changes, including food fibers, pigment, and other bioactive compounds due to processing and storage. Relevant factors affecting its application and its effect to human health are assessed by bioassay. Nutrification and intervened food are also developed.		

TPP81004	ADVANCED FOOD PROCESS ENGINEERING	2 CREDITS (2-0)
Students are expected to re-describe theoretical concepts of basic engineering function and apply them to food processing. The course encompasses mass and energy balances, thermal process, steady and unsteady thermal concepts, rheology, cooling and freezing, as well as Supercritical CO_2 Extraction for food processing. Implementing basic engineering is expected to be mastered for determining production capacity based on mass balance, energy efficiency and sufficiency, fluid transports as well as estimating the rate of food freezing.		

TPP81005	ADVANCED FOOD MICROBIOLOGY	2 CREDITS (2-0)
The course describes taxonomy and the roles of microbes related to food processing. Microbial inactivation kinetics in non-thermal food processing are also learnt, including HPP, PEF , ultrasound, ohmic heating, radiation, ultra violet, microwaves, oscillating magnetic Advanced microbial identification covering chemical and physical methods, immunology, ELISA, finger printingas well as bioassay are also		

explained. Characteristics of mikroba extremofil microbes and their application in industry are described.

TPP81006	**ADVANCED FOOD BIOCHEMISTRY**	**2 CREDITS (2-0)**
Students are expected to accurately re-describe the metabolism process of carbohydrate, protein, and fat, including their anabolism and catabolism mechanism. Any biochemical changes of carbohydrate, protein, fat, pigments, enzymatic browning on food are also discussed. Specific biochemical changes on meat and poultry are separately discussed.		
TPP82001	**SELECTED TOPIC SEMINAR IN THE FIELD OF AGRICULTURAL PRODUCT TECHNOLOGY**	**2 CREDITS (2-0)**
Students are expected to write and disseminate review articles on selected topics related to proposed thesis topics. The paper is formulated by critically reviewing and analyzing journals and any previously published papers. Presentation and review paper writing techniques are also discussed.		

TPP82002	**BIOACTIVE NATURAL PRODUCTS**	**2 CREDITS (2-0)**
The course will provide students with a knowledge of natural products obtained from various sources and their toxicology. The basic principle of extraction and isolation of bioactive materials from natural materials. Bioactive efficacy screening test (bioactive as antioxidant, IC50, antibacterial, anti-inflammatory, anticancer). Effects of metabolites to cell tissues. Toxicity test on cell organs (liver, kidneys and lungs). The concept of bioactive toxicology measurement (LD50, ED50, TI, ADI, TDI, NOEAL and LOEAL). Biotransformation mechanism of xenobiotics. In vitro toxicity test and bioactive physiological kinetics in animal (rat) / human. The technique for determining the positive and negative impacts of bioactive isolated from herbs. The basic principle of the test method for bioactive toxicity (acute, sub-chronic and chronic) in experimental animals. Dosing techniques in experimental animals in vivo. In vivo bioactive testing of herbs / fauna. Bioactive as immunomodulator (stimulator and suppressor) in animal and human cells.		

TPP82003	**ADVANCED ENZYME TECHNOLOGY**	**3 CREDITS (3-0)**
This course covers properties of enzymes; enzymes classification; enzyme isolation; the structure of enzyme, enzyme kinetics; enzyme specificity and mechanism; enzyme inhibition and activation; biosynthesis of enzymes; purification and characterization of enzyme; immobilized enzymes; the role of enzyme in biotechnology; the application of enzyme on the industrial field.		

TPP82004	**CHEMISTRY OF FOOD COMPONENTS**	**2 CREDITS (2-0)**
This course covers any discussions related to specific food components chemically and physically, including their functionality. Those contributions on food characteristics are also discussed, particularly related to types of vitamins, pigments, fats, proteins, sugars, starch and other carbohydrates (cellulose, pectin, seaweed-polysaccharide, microbial gum, seed gum, guar gum, etc). Specific reactions such as Maillard reaction and starch gelatinisation related to amylographic characteristics are also discussed. Nonetheless, any reactions on fats and proteins are also elaborated. The discussion includes functional forming of food components through foaming, gelation,emulsification, etc.		

TPP82005	**PHYSIOLOGY OF AGRICULTURAL PRODUCTS**	**2 CREDITS (2-0)**
Students are expected to analyse, sintheses, and evaluates physiology process and technology application on agriculture materials. These outcomes are formulated to be achieved by designing research methods related to physiology process and post-harvest technology for improving shelf-life of both fresh and processed products.		

TPP82006	**ADVANCED FOOD PROCESSING ENGINEERING**	**2 CREDITS (2-0)**
Students are expected to re-describe theoretical concepts of basic engineering function and apply them to food processing. The course encompasses mass and energy balances, thermal process, steady and unsteady thermal concepts, rheology, cooling and freezing, as well as		

Supercritical CO2 Extraction for food processing. Implementing basic engineering is expected to be mastered for determining production capacity based on mass balance, energy efficiency and sufficiency, fluid transports, and estimating the rate of food freezing.

TPP82007	**FOOD SAFETY MANAGEMENT**	**2 CREDITS (2-0)**
This course encompasses developments of food safety management systems, including the discussions of health and halal aspects through food safety risk managements and evaluation of food safety systems.		
TPP82008	**INTEGRATED QUALITY CONTROL**	**2 CREDITS (2-0)**
This course encompasses in detail quality control tools such as SQC, Six Sigma, FMEA, Taguchi Technique, etc and their applications in food industries based on continous improvement philosophy. Technical redefining process such as Concurrent engineering, QFD and business process re-enginering are also dicussed. Further process analysis, including quality cost estimation and evaluation are covered.		

TPP82009	**PRODUCT DEVELOPMENT AND INNOVATION MANAGEMENT**	**2 CREDITS (2-0)**
This course encompasses concept/idea management, scientific rights management related to product development in the food industry. Product development strategies related to the current situation, product life cycle, consumer behavior, marketing strategy, engineering, and management aspect of production as well as decision techniques are also discussed.		

TPP82010	**ESTIMATION OF SHELF LIFE AND STABILITY OF FOOD PRODUCTS**	**2 CREDITS (2-0)**
This course encompasses methods and mechanism of shelf-life estimation through integrated assessment. It covers shelf-life evaluation process, accelerated storage technique, the influence of humidity, temperature, microbiological status and sensory aspects on shelf-life prediction. The influence of packaging related to shelf-life is specifically discussed.		

TPP82011	**INTEGRATED SENSORY SCIENCE AND CONSUMER STUDIES**	**2 CREDITS (2-0)**

This course elaborates physico-chemical process related to sensory caharacteristic of food on processing and storage for emphasizing and achieving comprehensive sensory evaluation based on standard principals and application of multivariate techniques for understanding sensory perception and consumer preferrences.

TPP82012	**WASTE MANAGEMENT**	**2 CREDITS (2-0)**
This course elaborates waste management system according to national regulation. Current updates on waste treatment technology are also discussed. A case study of waste treatment management on agricultural product technology industries is highlighted.		

TPP82013	**ADVANCED BIOPROCESS TECHNOLOGY (*)**	**2 CREDITS (2-0)**
This course covers the scope of bioprocess technology and its important roles for the industry. The topics include strain improvement techniques(mutation, recombined-DNA technology), metabolic engineering, fermentation system, bioreactor, optimizing strategy for fermentation, modeling and bioprocess simulation, cascade control system, mammalian cell culture.		

TPP82014	**ADVANCED FOOD FERMENTATION**	**2 CREDITS (2-0)**
This course describes the process and production techniques of fermented food, including its benefit to human health. Specified indigenous fermented foods from several countries are described. Bioactivity and bioavaliability of microorganism are discussed related to updated technology for producing fermented food to enhance its functionality. Current updates and selected topics of fermented foods are also discussed.		

TPP82015	**FOOD SAFETY MICROBIOLOGY**	**2 CREDITS (2-0)**
This course covers microbiological aspects of food safety. The topics include : natural food pathogen and its toxin, related diseases characteristics, its diagnosis, pathogenesis mechanism as well as incident outbreak.		

TPP82016	MICROBIOLOGY AND INDUSTRIAL BIOTECHNOLOGY (*)	2 CREDITS (2-0)
Physiology of microbe (structure and function of microbe cells); growth and nutrition of microbe; metabolism of microbe; bioprocess (media of fermentation; fermentation system; optimization of fermentation; downstream processing, products development, regulation and safety of products. Industrial process and products (enzymes, biofuel, health care products, food and beverages products, food additives, antibiotics, microbial biomass).		

TPP82017	ENVIRONMENTAL BIOTECHNOLOGY	2 CREDITS (2-0)
This course describes the scope of environmental biotechnology, which covers international convention on environment, environmental effects to food security, micobial ecology, geochemical cycle, bio-fouling, bioremidiation technology, phyto-remediation, clean production, extreme-microbes, organic pollutant degrading microbes, microbial responses to detergent, phosphate compounds decrease in water.		

TPP82018	CELL AND MOLECULAR BIOLOGY (*)	2 CREDITS (2-0)
This course discusses genetic analysis in molecular biology; macromolecules; nucleic acids; structure and function of DNA, RNA and protein; DNA replication, DNA technology; the physical structure of protein molecules; mutagenesis and mutation; transcription; translation; regulation and activity of genes in procaryotes; regulation in eukaryotes.		

TPP82019	GENETIC ENGINEERING (*)	3 CREDITS (3-0)
This course covers genetics coding, genetic elements for controlling gen expression, cloning strategy, cloned gene analysis,gen structure and functions analysis, DNA-recombinants technology and applications in food, aquatic, health, agriculture, bioenergy and bioremidiation, current issues on genetics engineering, and bio-ethics.		

TPP82020	ENZYMOLOGY (*)	3 CREDITS

		(3-0)
This course covers enzyme characteristics, classification, enzyme isolation, enzyme structure, enzyme kinetics, enzyme specificity and mechanism, enzyme inhibition and activation, enzyme bio-synthesis, enzyme purification and characterization, and enzyme immobilization, the roles of enzyme in biotechnology, industrial application of enzyme.		

TPP82021	**FOOD BIOTECHNOLOGY (*)**	**3 CREDITS (3-0)**
This course covers recombined-DNA technology, cloning techniques, and food biotechnology to produce new food products, including food ingredients, dairy products, meat products, flavor, oil and fats, sweetener, and vegetable products. Detection methods in foods as well as the impacts on food quality and safety and environment are discussed. Consumer perception on Genetically Modified Food as well as industrial perspective are also covered.		

TPP82022	**EPIDEMIOLOGY AND NUTRITIONAL STATUS**	**2 CREDITS (2-0)**
This course discusses the life-cycle of nutrients, nutrition epidemiology design, nutrients status assessments, diet and consumption pattern, and the relations of nutrition and diseases.		

TPP82023	**ADVANCED HUMAN PHYSIOLOGY AND NUTRIENT METABOLISM**	**2 CREDITS (2-0)**
This course covers the use of nutrients for the human body (particularly macro-nutrients such as carbohydrates, fat, and protein). Metabolism pathways of those nutrients, including their regulation in the human body, are discussed together with organs and hormones' function.		

TPP82024	**NUTRITION AND SPECIAL DIETS**	**2 CREDITS (2-0)**
This course covers food habits/ diets related to human health, including diet for sick prevention and recovery. Degenerative illness diet, food combining, vegetarian diet, detox diet are also discussed.		

TPP82025	**NUTRITION AND IMMUNOLOGY**	**2 CREDITS (2-0)**

This course discusses the basic principles of immunology, protection, and security system to infection and foreign substances due to their interaction with the environment. The roles of foods (nutrients and bioactive) to enhance immunity are discussed. Monoclonal antibody production techniques through cell culture and immuno-chemical and its food application, are also described.

TPP82026	**NUTRIGENOMICS**	**2 CREDITS (2-0)**
This course describes the genomic application for nutrition and health. Molecular nutrition and genomic techniques for analysis are also studied. Its application for preventing and interventing diseases in regulating food nutrition for maintaining homeostasis is described, including gen and nutrient interaction for regulating diseases pathway.		

TPP82027	**DEVELOPMENT OF FUNCTIONAL FOOD AND SUPPLEMENTS**	**2 CREDITS (2-0)**
This course discusses the concepts, health claims, regulation, prospects and potential of functional food and supplement, the roles of nutrients, food fibers, and bioactive compounds as antioxidants, anti-infection, and immunomodulators degenerative health diseases. The development of functional food and supplement are based on local wisdom, including traditional food.		

TPP82028	**LABORATORY WORK OF NUTRITION AND BIOACTIVE COMPOUNDS**	**2 CREDITS (2-0)**
The laboratory work covers the evaluation of nutritive and bioactive compound peculiar properties, including extraction and isolation of bioactive compounds, its identification qualitatively and quantitatively followed by in-vivo test involving experimental animal as well as in vitro test using cell culture.		

TPF80001	**THESIS**	**12 CREDITS (12-0)**
Students are required to write a research proposal and present it. Students then research following the proposal approved by the supervisor. The research results are written in the form of a thesis.		

5.2.2. DEPARTMENT OF AGRICULTURAL ENGINEERING

The Master of Agroindustrial Engineering and Biosystem

TPE 81001	RESEARCH METHODOLOGY	3 CREDITS (3-0)
This course provides science philosophy understanding and learn the way to do scientific research, start from identification, selection, and problem formulation, literature review, variable identification, research, observation and data collection, analysis result interpretation and the procedure of writing scientific work, including: research idea, research report (thesis) and scientific publication.		

TPE 81002	AGRICULTURAL ENGINEERING AND BIOSYSTEMS MANAGEMENT	3 CREDITS (3-0)
This course has several subjects that include Agricultural engineering and biosystems definition, scope at the macro and micro levels. Bioprocess technology and bioproduct, Characteristic of biomaterial composite, ceramic, metal, and polymer. Biorefinery, including bioenergy.		

TPE 81004	TECHNO ECONOMY	3 CREDITS (3-0)
This course contains the concept of analysis model and applying the techno economy for planning, feasibility evaluation, and implementation in agricultural engineering and agroindustry. The techno economy notion includes raw material procurement technology and management, process technology determination and its capacity, operational management, economic and financial feasibility analysis.		

TPE 81005	ADVANCED MODELLING AND OPTIMIZATION TECHNIQUES	3 CREDITS (3-0)
This course explains about dynamic modeling system using differential equations. Introduction to variable position method of system analysis. Mechanical power, electric and fluid system analysis. Solving differential equations, both analytically and numerically. Finite different & Finite element. Introduction to classical control theory. Feedback and stability that is applied in S domain. Frequency response as experimental tools and analysis. MATLAB application for modeling. Group projects and		

individuals are needed for graduation credit.

TPE 81006	DESIGN TECHNIQUES	3 CREDITS (3-0)
This course studies design philosophy, basic principles of planning and designing components, equipment, and machine products starting from specifications, concepts, design, optimization, documentation, prototypes and trials, understanding the principles of material strength, material properties, joint stress, design for various types of loading, and column analysis and design. The approach to fatigue resistance design has been changed from the Soderberg criteria to the Goodman method. The power transmission system's design emphasizes the relationship between engine elements by paying attention to each element's unique characteristics. It covers belt transmission, chain transmission, gears, shafts, docks, couplings, seals, rolling bearings, and finishing power transmission design.		

TPE 82019	AGRO-BIOSYSTEM MACHINERY DESIGN	3 CREDITS (3-0)
This course learns about operation characteristics from the design aspect related to process equipment and food and fiber production, mechanization equipment evaluation for production, and agro-bio-system processes. Quantitative and qualitative performance test, result analyzing, and specification development for final design. The relation between process and material characteristics. Process parameter setting against material. Major project: Designing agro biosystem machine as an individual project.		

TPE 82020	ALTERNATIVE RENEWABLE ENERGY	3 CREDITS (3-0)
This course explains the search for renewable energy sources, which concern the study of solar energy, wind, and alternative biology energy in depth. Also involving principles, technology, and performance evaluation for those technologies component and a preliminary on water, geothermal and other energy: Energy conservation; combined generation; electricity production using wasted heat. Financing, Economy, and other issues related to alternative energy sources.		

TPE 82021	BIOPRODUCT PROCESS TECHNOLOGY	3 CREDITS (3-0)
This course provides insight into advanced bioprocess techniques by emphasizing several modeling aspects and processing from eukaryotic systems combined with biological-based products. Module includes heat processing, fluid extraction on supercritical condition, advanced biological material thermodynamics, chromatography, and spectroscopy.		

TPE 82001	ENGINEERING HYDROLOGY	3 CREDITS (3-0)
This course contains hydrological cycle, infiltration, interception, evaporation, surface water stream, routing, frequency analysis, and groundwater stream, including aquiver and well-pumping test, hydrologic measurements rainfall measurement, open and closed channel discharge measurement, infiltration and evaporation measurement.		

TPE 82002	SPATIAL TECHNOLOGY	3 CREDITS (3-0)
This course contains about database concept and geographic information system; Analysis and Spatial Modeling; Digital Elevation Model (DEM), Model; Simulation and Integration with Spatial Information System; GPS and data acquisition; Hydrology modeling for watershed water resource management; GIS and Natural resource management.		

TPE 82003	NATURAL RESOURCES MANAGEMENT TECHNIQUES	3 CREDITS (3-0)
This course explains erosion, destructive force of water, agroindustry waste; land critically assessment and river flow area, environment pollution; water and soil conservation techniques, agroindustry waste processing, Environmental and social impact assessment, and environmental management and monitoring report and every environmental policy.		

TPE 82004	DECISION-MAKING TECHNIQUES	3 CREDITS (3-0)

This course explains manager and decision-making; managerial decision-making and information system; a framework that supports the decision; decision supporting concept; supporting decision system of company information system; knowledge management system, expert system.

TPE 82005	**AGRICULTURAL MECHANIZATION SYSTEM ANALYSIS**	**3 CREDITS (3-0)**
The lecture encompasses concept-theory about agricultural mechanization system. Identifying and evaluate agricultural mechanization problems and hindrance. Agricultural mechanization needs. Improvement and proposed improvement		

TPE 82006	**AGRICULTURAL POWER AND MACHINERY MANAGEMENT**	**3 CREDITS (3-0)**
Topic including Machine performance, Machine cost, Owning cost, Worker cost, On-time cost, Machine total cost. Factors that can affect machine needs, number of plants/ha, labor supply, risk management, planting and harvesting date, field capacity, adjusting suitable size and power, estimate the number of days required		

TPE 82007	**PHYSICAL PROPERTIES OF AGRICULTURAL PRODUCTS AND MATERIALS**	**2 CREDITS (2-0)**
This course contains the origin, variety, structure, and physiology of vegetable and animal products. Momentum application, heat and mass transfer in food processing; refrigeration, freezing, and controlled atmospheric storage. Analysis of the chosen unit operation used in food processing. Extrusion, dehydration, heat processing.		

TPE 82008	**MECHATRONICS FOR AGRICULTURAL TOOLS AND MACHINERY**	**4 CREDITS (4-0)**

This course consists of several main subjects: modeling principle, interface, Laplace, and transfer function. Introduction to electronics used in agroindustry field. Introduction to number system and logic circuit. Introduction to sensor and actuator component and how it works. Processing principle and signal conditioning. Digital data conversion to analog and vice versa. Digital control design method that is commonly used. Non-linear effect introduction and compensation in the mechatronic system. Introduction to PLC (Programmable logic controller) component and procedure. Process control using PLC.

TPE 82009	**ENERGY CONVERSION TECHNIQUES**	**2 CREDITS (2-0)**

This course provides an insight into energy and its source. Type and classification of energy. Law and equation in energy conversion. Energy profile: source, reserve. Resource and classification of energy conversion machine. Fuel on energy conversion. Renewable energy. Non-renewable energy. Combustion engine classification. The calculation for internal combustion engine performance. Steam power plant. Fluid machines. Cooling machine classification. Thermodynamic cycle of cooling machine. Conservation energy technique on vehicle, industry, and building.

TPE 82010	**INSTRUMENTATION AND CALIBRATION**	**2 CREDITS (2-0)**

This course provides a general description of modern instrumentation and digital electronic components and subsystems to integrate into the biosystem's digital data acquisition and control system. Accentuation in laboratory equipment usage. Topics including instrument characteristics, signal conditioning, transducer theory, theory and transducer application, PLC acquisition, and digital data controlling.

TPE 82011	**ADVANCED ENVIRONMENTAL CONSERVATION TECHNIQUES**	**2 CREDITS (2-0)**

This course explains conservation and the necessary technological effort, surface water, groundwater, air, coral reefs, mangrove forest, and beach conservation technique. Environment behavior and process, integrated conservation knowledge.

TPE 82012	ADVANCED WATER SUPPLY AND IRRIGATION	2 CREDITS (2-0)
This course explains about inventory and identification of potential water resource, whether its a rainwater, surface water, groundwater, air and soil humidity; Irrigation and drainage planning and design for agricultural land, including method to determinate plants need for water, irrigation efficiency, and water balance; water resource management for river flow area and rural areas, including optimation method application in water management.		
TPE 82013	**WASTE TREATMENT AND MANAGEMENT**	**2 CREDITS (2-0)**
This course explains the pollution caused by the agricultural production process. Formation mechanism, distribution, and handling techniques. Pollution reduction hierarchy and waste management. Wastewater and sludge handling technique from the agricultural production process and processing of agricultural product. Handling technique for air pollution from the agricultural industry. Management and handling techniques for solid waste. Agricultural waste utilization and its processing technology. Issues and concepts related to recycling system design and domestic waste processing, and small-scale commercial waste. Major project: Design a waste processing unit individually.		

TPE 82014	ADVANCED DRAINAGE	2 CREDITS (2-0)
This course consisted of several main topics, including terminology, component, and urgency on wastewater distribution and drainage, wastewater and rainwater drainage system: Separated, mixed, strength and weakness of every drainage system. Wastewater classification, whether its caused by human activity or natural; wastewater quantity from domestic activity, commercial, industrial, both its organic load or hydraulic load; rational method from rainwater quantity, not only intensity, reset periods and distribution application; collection system designing and wastewater		

drainage, energy concept in drainage, separate and mixed system, layout pattern system, conduit type and technical specification; Drainage operation, maintenance and its tools also management institution from a wastewater drainage system.

TPE 82015	AGRICULTURAL MECHANIZATION PROJECT MANAGEMENT	3 CREDITS (3-0)
This course discusses several aspects of agricultural mechanization project management, including mechanization, integrated management, scheduling, cost management, quality management, risk management and procurement management, project human resources management, and communication.		
TPE 82016	**SUSTAINABLE AGRICULTURAL ENGINEERING**	**2 CREDITS (2-0)**
This course discusses integrated agricultural engineering with the Low External Input concept for Sustainable Agriculture (LEISA) concept, organic fertilizer versus synthetic fertilizer. This organic compound is useful for HEIA (High External Input Agricultura) Organic Agriculture, fishery-livestock integration with agricultural cultivation. Sustainable agriculture indicator. The benefits of sustainable agriculture. Cultivation technology supports sustainable agriculture, as organic hydroponic technology in urban farming, waste utilization technology for agriculture cultivation with bioremediation and phytoremediation in supporting sustainable, environmentally-friendly agriculture.		

TPE 82017	AGRICULTURAL ENGINEERING INFORMATION SYSTEM	3 CREDITS (3-0)
This course explains data, concepts, information and agricultural engineering information system, design and improvement of the information system in agricultural engineering.		

TPE 82018	AGRICULTURAL PRODUCT MARKETING MANAGEMENT	3 CREDITS (3-0)
Subjects covered sales plan, market segment establishment, price-fixing, product design and packing, distribution channel and sales promotion.		

5.2.3 DEPARTMENT OF AGROINDUSTRIAL ENGINEERING
The Master of Agroindustrial Engineering

TPI81001	**AGROINDUSTRY MATERIAL SCIENCE**	**2 CREDITS (2-0)**
This course discusses the composition of agricultural material and products based on commodity and benefits, any metabolite compounds released from agricultural products, both primary and secondary metabolites, the productivity and the quality of various aspects of agricultural products, and nutritional values. It also discusses the industrial tree of agricultural products and the potential development of the production process.		
TPI81002	**RESEARCH METHOD ANDAN SCIENTIFIC WRITING**	**2 CREDITS (2-0)**
Subjects covered the philosophy of research, the theoretical and practical skills to plan, conduct, analyze, and present, orally and in written form, a scientific assignment in the area of information and communication technology and give insight and understanding of research methodology, ethics, and sustainability. The course has also covered research and technology development, theory development, the objectives, hypothesis scheme, research benefits, thesis strategy, and scientific research method. Additionally, this course will guide students through publishing research in technical journals and feedback on their writing and presentation skills.		

TPI81003	**SYSTEM MODELING ANALYSIS**	**2 CREDITS (2-0)**
Understanding modeling for system analysis and design of agroindustry. The course includes strategy system, problems and models simulation, characteristics, principles, models systems clarification, inventory modeling, inventory buffers, modeling reactor heater, modeling non-linear equation solution, preliminary dynamics system, system dynamics, modeling presentations.		

TPI81004	AGROINDUSTRY PRODUCTION SYSTEM	2 CREDITS (2-0)
This course discusses the concept and scope of production systems, forecasting, line balance, Operations Scheduling/ Manufacturing Execution Systems, operating technology in the Agroindustry system.		

TPI82001	AGROINDUSTRY TECHNO-ECONOMY	2 CREDITS (2-0)
Techno-economy aspects on agroindustrial, change and innovation technology, techno-economy agroindustry analysis, technology and economic growth, implementation and analysis study. The concept and application of techno-economy models for planning, feasibility assessment, implementation on agroindustry, and the process technology and capacity determination and operational management.		

TPI82002	BIOTRANSFORMATION ENGINEERING	2 CREDITS (2-0)
This course includes the introductory materials, basics of molecular biology, basic gene transformation, DNA manipulative enzymes, biotransformation, oxidoreductase, hydrolase, enzyme technology, biocatalist design, biotransformation in the food industry, vanillin biotransformation, understanding, scope and development of industrial biotransformation/biocatalysis, and preparation of microbes for the biotransformation process (isolation, selection and preservation). Microbial cell cultivation and harvesting methods. Classification of biotransformation reactions and products; improved performance of the biotransformation process (increased microbial enzyme biocatalysis: activity, selectivity, stability; improved processes: substrate-yield conversion, product concentration, process productivity); Introduction of plant cell biotransformation products; bioreactor selection for biotransformation.		

TPI82003	AGRO-INDUSTRY SUPPLY CHAIN STRATEGY AND MANAGEMENT	2 CREDITS (2-0)
This course discusses the concept of sustainable supply chains, decision support models, multiple criteria decision making, sustainable indicators, performance measurement models, risk assessment models and sustainable strategies in agro-industrial systems.		

TPI81005	AGROINDUSTRY QUALITY SYSTEM AND MANAGEMENT	2 CREDITS (2-0)
This course discusses the concept of quality and quality attributes, quality systems at the medical and national levels, application of Total Quality Management (TQM), Hazard Analysis Critical Control Point (HACCP), introduction to Halal Assurance System (HAS), ISO Series 9000, ISO 22000, ISO 14000, Kaizen, Six Sigma, plus recent topics such as Geographical Indication Certification, and agro-industrial product quality standards in international trade and Indonesia.		

TPI81006	AGROINDUSTRY INNOVATION AND STANDARDIZATION	2 CREDITS (2-0)
This course discusses the linkage of innovation research and standards, types of innovation supporting agroindustry, central and regional innovation institutions, global and national scale standardization regulations, standardization in the agroindustry sector, several forms of product standards, quality systems, and services related to agroindustry, international trade standardization, as well as rights to intellectual works (IPR).		

TPI81007	HUMAN RESOURCE DEVELOPMENT	2 CREDITS (2-0)
This course is concerned with developing knowledge and skills for a workforce's management organization through the design and implementation of effective human resources policies and procedures, including equality in employment, job analysis, agroindustrial human resource management, strategy development, human intelligence, human resource development models, career development of human resources, learning organization, knowledge management, training and development.		

TPI81008	DECISION SUPPORT SYSTEM	2 CREDITS (2-0)
The decision support systems prepared for agroindustry managers and information systems which capable of supporting the process operations of agroindustry. Disciplines of this course is a combination of several different disciplines: mathematical models, database systems, expert systems, operations research, management science, engineering graphics, and		

engineering development trending system objects in the fields of agroindustry.

TPI81009	AGROINDUSTRIAL BIOTECHNOLOGY	2 CREDITS (2-0)
Knowledge on cultivation process design covering environmental factors which affect microbial growth, enzymatic processes, as well as the various biotechnology products, primary metabolites, enzymes, comparison process and strain, kinetic engineering, fermentation technology, modern biotechnology (recombinant DNA), protein synthesis, gene cloning, gene expression, bioinformatics, functional gene analysis, recombinant protein production.		

TPI81010	PROCESS ENGINEERING AND SECONDARY METABOLITE PRODUCT	2 CREDITS (0-2)
The classification of secondary metabolite products and characteristics of secondary metabolites (isoprene-terpenes, phenolics, alkaloids, glycosides complex, amine plants, sapogenin, etc.). The technology of process extraction, tools, and machinery of secondary metabolite production as well as the advantages of its development.		

TPI81011	AGROINDUSTRY WASTE TECHNOLOGY AND MANAGEMENT	2 CREDITS (0-2)
This course covers the scope of waste management and industrial environment, issues of waste and environmental problems as well as engineering and processing engineering of liquid, solid and gas waste technology, covering aspects of pre-treatment, process, post-treatment, value-added products from waste, environmental management system, techno-economic analysis and life cycle analysis, especially in agroindustry.		

TPI82004	BIOENERGY AND BIOREFINERY	2 CREDITS (0-2)
This course contains the concept of bioenergy (bioethanol and biogas production) and biorefineries related to the potential use of agricultural waste containing lignocellulose or non-lignocellulose (such as algae, green biorefinery) and the potential for physical, chemical, biological degradation		

products in producing bioethanol or chemicals. Valuable functions and roles in the development of bioenergy and biorefinery products.

TPI82005	**BIOREMEDIATION**	**2 CREDITS (0-2)**
The lecture materials include types and methods of bioremediation, microbial bioremediation, phytoremediation, soil bioremediation, air bioremediation, water bioremediation, bioremediation molecular techniques, biodegradation of organic matter, metal biotransformation, in-situ and ex-situ bioremediation, and bioremediation applications.		

TPI82006	**PALM PROCESS ENGINEERING**	**2 CREDITS (0-2)**
This subject covers palms' classification, primary and secondary metabolites of Palma plants, primary and secondary product processing technology, quality standards for palm products, production tools and machines, and palm plant production systems.		

TPI82007	**FATS AND OLEOCHEMICAL PROCESS ENGINEERING**	**2 CREDITS (0-2)**
This course discusses the structure, composition, and physicochemical properties of fats, products produced from fat, fat extraction, and purification techniques. This course also discusses the principle of changing the character of fat molecules during processing, the principle of derivatization of fat molecules to produce oleochemical products (basic and derivative), chemical transformation techniques of fat which are oriented towards the development of their derivative products, and the application of fat in emulsion technology for various industrial needs.		

TPI82008	**TECHNOLOGY ENGINEERING AND PROCESS DESIGN**	**2 CREDITS (0-2)**

This course covers the role of process design in the agricultural processing industry, the structure and criteria for processing systems, process engineering for agroindustry, design stages, heuristic methods for process synthesis, optimization techniques for process design, scale-up of processes and equipment; analysis of economic feasibility and profitability. Process and plant design tasks in the agricultural industry. Lectures cover engineering principles, chemical engineering and kinematics, reactor principles, pilot plant experiments, process design, pulse electric field (PEF), extraction using PEF, Lethal value, death curves & effective processes, Nanotechnology in agroindustry, ISL curves, microwave processing & identification, extruder.

TPI82009	**ADVANCED OPTIMIZATION TECHNIQUE**	**2 CREDITS (0-2)**
This course discusses quantitative optimization techniques that can be used for agro-industrial operation solutions. An introduction to the theory of error to numerical computations. Optimal conditions for problems without constraints and problems with constraints.		

TPI82010	**ADVANCED RISK MANAGEMENT**	**2 CREDITS (0-2)**
This course discusses the scope of risk management, type and risk aspects, methods, and analysis of risk aggregation. The insight into risk-product development, Monte Carlo simulation, as well as case studies related to risk management occurred in the field of agroindustry		

TPI82011	**HALAL INDUSTRY**	**2 CREDITS (0-2)**
This course discusses the basic concepts of the halal industry, the principle of halal haram (halalan thoyyiban), market opportunities for halal products including food, pharmaceutical, health and cosmetic products, analysis techniques for determining the halal status of products (haram detection techniques), Halal Assurance System (HAS) various products, Halal Control Point (HCP), traceability in the supply chain of the halal industry. In addition, it also explains the latest halal regulations on a global and		

national scale, the development of various halal products and related services, and the relationship between HAS in food integrity.

TPI81012	**INTEGRATED AGROINDUSTRY DEVELOPMENT (LAB WORK)**	**2 CREDITS (0-2)**
This course is a work simulation in agroindustry, which includes the process of procurement of raw materials, production, quality control, analysis of shelf life, marketing of a food product, and the economic feasibility of agro-industrial products on a pilot plan scale.		

5.3. SYLLABUS OF DOCTORAL PROGRAM

5.3.1. Doctoral Program Faculty Courses

TPF92001	**QUALIFICATION TEST**	**1 credit (1-0)**
Students compile a pre-proposal containing study material that will be used as research material. Qualification examinations are carried out to assess students' readiness theoretically, conceptually, and technically to carry out their dissertation research. In this exam, students must be able to demonstrate their eligibility to conduct research independently to obtain a doctorate in food science. ***Learning Outcome (LO):*** *1. Students are able to review the literature and it is relevant to the dissertation topic.* *2. Students master scientific concepts related to the research topic of their dissertation.* *3. Students are able to formulate research problems to be carried out.*		

TPF92002	**PROPOSAL WRITING AND PROPOSAL EXAMINATION**	**2 CREDITS (2-0)**
Students must compile a research proposal under the supervision of a promoter and co-promoter and the proposal is a research guide for preparing a dissertation. The promoter and co-promoter provide direction and advice according to their competence; thus, the research's content is worthy of a doctorate in food science. This process requires intensive		

discussion with the promoters and co-promoters. The proposal must demonstrate the student's ability to conduct research independently and have good research quality to obtain a doctorate. After the promoter and co-promoter approve the proposal, students must present it in front of the promoter, co-promoter, and examiner appointed by the head of the study program. ***Learning Outcome (LO):*** 1. *Students are able to review literature in-depth and relevant to the topic of the dissertation.* 2. *Students are able to identify, formulate, and solve problems.* 3. *Students are able to plan and compile research methods for their dissertation research.* 4. *Students master the knowledge of state of the art upon his/her dissertation research topics*		
TPF91001	**RESEARCH AND SEMINAR ON RESEARCH RESULT I**	**6 CREDITS (6-0)**
Research and research in progress seminar have 18 credits classified into 3 phases consisting of 6 credits each. These phases could correspond to the dissertation proposal's phases or not because it does not have three research phases. The students must manage the materials of this research in progress seminar, thus becoming three phases. The division of three phases is performed so that the promoter can regularly monitor the progress of research and scientific paper writing in the journal. If the data obtained have not yet been completed, students can add material for in progress seminar from the literature reviews on topics related to their research. The progress seminar's research activity can be internally held attended by the promoter and co-promoter, or student attends national or international scientific seminars, conferences, or meetings. The student must have submitted a publication draft in the seminar on the research result according to the result data. If research is still in progress, the publication draft does not have to be 100% complete to publish; meanwhile, the data that have been obtained and consulted with promoters are discussed in the international scientific publication draft. Student participation in seminar activities or national and international scientific meetings must include the promoter and co-promoter approval. The advisory team assesses national and international scientific seminars. ***Learning Outcome (LO):*** 1. *Students are able to carry out research independently*		

2. *Students are able to carry out analysis and synthesis on data of research in progress result*
3. *Students are able to communicate in progress research result both in written and orally.*

TPF92003	RESEARCH AND RESEARCH SEMINARS II	6 CREDITS (6-0)

Research and research in progress seminar have 18 credits classified into 3 phases consisting of 6 credits each. These phases could correspond to the dissertation proposal's phases or not because it does not have three research phases. The students must manage the materials of this research in progress seminar, thus becoming three phases. The division of three phases is performed so that the promoter can regularly monitor the progress of research and scientific paper writing in the journal. If the data obtained have not yet been completed, students can add material for in progress seminar from the literature reviews on topics related to their research. The research activity in progress seminar can be internally held attended by the promoter and co-promoter, or student attends national or international scientific seminars, conferences or meetings. The student must have submitted a publication draft in the seminar on the research result according to the result data. If research is still in progress, the publication draft does not have to be 100% complete to publish; meanwhile, the data that have been obtained and consulted with promoters are discussed in the international scientific publication draft. Student participation in seminar activities or national and international scientific meetings must include the promoter and co-promoter approval. The advisory team assesses national and international scientific seminars.

Learning Outcome (LO):

1. *Students are able to carry out research independently*
2. *Students are able to carry out analysis and synthesis on data of research in progress result*
3. *Students are able to communicate in progress research result both in written and orally.*

TPF91002	RESEARCH AND IN PROGRESS RESEARCH SEMINAR III	6 CREDITS (6-0)

Research and research in progress seminar have 18 credits classified into 3 phases consisting of 6 credits each. These phases could correspond to the

dissertation proposal's phases or not because it does not have three research phases. The students must manage the materials of this research in progress seminar, thus becoming three phases. The division of three phases is performed so that the promoter can regularly monitor the progress of research and scientific paper writing in the journal. If the data obtained have not yet been completed, students can add material for in progress seminar from the literature reviews on topics related to their research. The progress seminar's research activity can be internally held, attended by promotor and co-promotor, or student attends national or international scientific seminars, conferences, or meetings. According to the result data, the student must have submitted a publication draft in the seminar on the research result. If research is still in progress, the publication draft does not have to be 100% complete to publish; meanwhile, the data that have been obtained and consulted with promoters are discussed in the international scientific publication draft. Student participation in seminar activities or national and international scientific meetings must include the promoter and co-promoter approval. The advisory team assesses national and international scientific seminars. ***Learning Outcome (LO):*** *1. Students are able to carry out research independently* *2. Students are able to carry out analysis and synthesis on data of research in progress result* *3. Students are able to communicate in progress research result both in written and orally.*

TPF91003	INTERNATIONAL PUBLICATION I	2 CREDITS (2-0)
Students are required to publish scientific articles in a reputable international journal. The promoter and co-promoter must agree on the international journal in question. According to Chancellor's Regulation of UB No. 52 of 2018, every doctoral student must complete the thesis in the form of a dissertation and scientific publication. The scientific publications are in the form of a). 2 (two) scientific articles in Scopus indexed international scientific journal or Web of Science Core Collection (Thomson Reuter) with the lowest impact factor of 0.1, or Microsoft Academic Search; or b). 1 (one) scientific article in the scientific journal as referred to the number 1 and 1 (one) article in the Proceeding. The thesis in the form of Scientific Publication in question is arranged according to the		

result of Dissertation research. Students, as the first author, must write one scientific publication. ***Learning Outcome (LO):*** 1. *Students are able to communicate between concept and research result clearly and effectively in the reputed journal.* 2. *Students understand the procedure of scientific manuscript dispatch to the reputed journal.*

TPF92004	**INTERNATIONAL PUBLICATION II**	**2 CREDITS (2-0)**
Students are required to publish scientific articles in a reputable international journal. The promoter and co-promoter must agree on the international journal in question. According to Chancellor's Regulation of UB No. 52 of 2018, every doctoral student must complete the thesis in the form of a dissertation and scientific publication. The scientific publications are in the form of a). 2 (two) scientific articles in Scopus indexed international scientific journal or Web of Science Core Collection (Thomson Reuter) with the lowest impact factor of 0.1, or Microsoft Academic Search; or b). 1 (one) scientific article in the scientific journal as referred to the number 1 and 1 (one) article in the Proceeding. The thesis in the form of Scientific Publication in question is arranged according to the result of Dissertation research. Students, as the first author, must write one scientific publication. ***Learning Outcome (LO):*** 1. *Students are able to communicate between concept and research result clearly and effectively in the reputed journal.* 2. *Students understand the procedure of scientific manuscript dispatch to the reputed journal.*		

TPF92005	**DISSERTATION WRITING AND DISSERTATION EXAM**	**5 CREDITS (5-0)**
Students must be able to compile a dissertation manuscript of the research result obtained properly and worthily to be examined in the final dissertation exam. Students are required to have at least 2 (two) scientific publications of the research Dissertation results published or accepted to be published to take the final dissertation exam. ***Learning Outcome (LO):*** 1. *Students are able to identify relevant theories and concepts, link*		

them to methodology and evidence, apply the appropriate techniques, and systematically draw the conclusion. 2. *Students are able to compile a research report with updated topics in their fields.* 3. *Students are able to interpret and apply the information into the literature to clarify their research.* 4. *Students represent their ability to provide a real contribution towards (recent) knowledge through their research.* 5. *Students are able to clearly and effectively communicate concepts and research results in scientific writing and orally.*

5.3.2 DEPARTMENT OF AGRICULTURAL PRODUCT TECHNOLOGY

The Doctor of Food Science

TPP91001	PHILOSOPHY AND RESEARCH METHOD IN FOOD SCIENCE	2 CREDITS (2-0)
This course contains the theory of ethic philosophy, what is called science and scientific knowledge. New issues in food technology, biotechnology or nutrition, and health and how the researcher should respond to those cases are discussed. The material of courses and discussions is expected to help students understand their role and responsibility in response to the changing environments. Researchers should have a Code of Conduct within internal or outside institutions in collaboration with others. This course also covers the new research methods in the food science field, such as new design experimental in the optimization process and product and the simulation using software. ***Learning Outcome (LO):*** 1. *Students are able to understand the theory of philosophy and ethics.* 2. *Students are able to understand the role of scientist and the responsibility to the changing environment in the field of food (food technology, biotechnology, nutrition, and health)* 3. *Students are able to understand ethic, code of conduct and integrity as scientists* 4. *Students are able to design an experiment in the field of food science.*		

TPP91002	ADVANCED FOOD SCIENCE	2 CREDITS (2-0)

As profoundly global climate changes, population, water, and energy, food science and applied food science are demanded to respond to those changes. This course discusses the current topics in food science, including food chemistry, food biochemistry, food processing and engineering (phase diagram, cryoprotectant, ozone process, cooling process, aseptic process, PEF technology, Ohmic technology, cold atmosphere plasma, microwave), food microbiology, food biotechnology and nutrition (including metabolism pathway and diseases, lifestyle and food pattern). Current research related to those topics are also discussed.

Learning Outcome (LO):

1. *Students are able to understand the emerging of food science in food chemistry, food biochemistry, food processing, food engineering, food microbiology, food biotechnology, and nutrition.*
2. *Students are able to explain the emerging in the specific field of food science.*
3. *Students are able to explain the role of each field of food science for life.*

TPP91003	BIOACTIVE COMPOUNDS AND THEIR USES	2 CREDITS (2-0)

Course of Bioactive Compounds and Their Use covers the bioactive compounds originated from plants and animals and their role as pharmaceutical or herbal to prevent human diseases. Students study the source of secondary metabolite bioactive, its structure and its function of either commercial or uncommercially available, metabolism pathway of how they are produced in plants or animals. Local sources from Indonesia are also explored as pharmaceutical or herbal. Student also studies extraction methods to isolate, to fractionate and to identify the bioactive compounds, the testing method including In Vitro, In Vivo and Ex Vivo. This course is designed to prepare students to be ready to write the research proposal. Other specific topics are bioactive compounds as antimicrobial, antioxidant, anti-inflammation, anti-tumor, anti-cancer, anti-diabetes, anti-cholesterol, and pharmaceutical from plants (peptide and plant protein) as antibody and vaccine. Students are expected 1) to be able to design experiments to explore new pharmaceuticals/herbals and to test the efficacy of the extract or *isolated compound in the laboratories 2) to be able to develop new products of pharmaceutical from plant or animals through the inter-, multi- and trans-disciplinary. Knowledge from this course can support students in explaining the phenomena in the natural compounds that can be developed as drug/herbal or functional food 3) to analyze, evaluate, and create a new commercial of a pharmaceutical drug or functional food product.*

Learning Outcome (LO):

1. *Students are able to analyze and evaluate secondary metabolite components from plants and animals, including concentration, structure, biosynthesis pathway, and the function of those secondary bioactive compounds.*
2. *Students are able to choose the extraction methods for natural materials based on the characteristic material and secondary bioactive compounds, be able to choose and evaluate fractionation methods, isolation and elucidation of secondary bioactive metabolites*
3. *Students are able to analyze, evaluate, and make secondary bioactive metabolites by using organism culture techniques*
4. *Students are able to analyze, evaluate and make secondary bioactive product using cell tissue culture or plant cell organ*
5. *Students are able to analyze and evaluate and make secondary bioactive product using marine animal culture*
6. *Students are able to analyze and evaluate some methods of biological activity of bioactive secondary metabolite*

TPP91004	INTERACTION OF FOOD COMPONENTS	2 CREDITS (2-0)

The course of Interaction of Food Component studies the basic principle of molecular interaction; basic principle of water and other food components interaction, protein and other food components interaction, carbohydrate and other food component interaction, lipid and other food components interaction, micro components interaction (vitamin, mineral, pigments, polyphenols etc.); the effect of those interactions on characteristic food product and nutrition aspect. Students are expected to explain the food system phenomena based on the interactions between components at molecular levels. This knowledge is used to explain the phenomena that occurred in food materials or food products. Students are also expected to analyze the changing of characteristics and quality of food. Therefore, it can *be used in food quality control. Students are expected to be able to understand the formation of the material characteristic and food product and the reactions occurred. Therefore, they can explain the phenomena in the food system.*

Learning Outcome (LO):

1. *Students are able to explain chemical phenomena underlying the formation of the characteristics of food materials and food products and the changes that occurred during the processing and storage.*
2. *Students are able to determine the chemical reaction changes that occurred during the processing and storage.*
3. *Students are able to analyze the chemical reactions and the interaction between food components resulting in characteristic changes of food products during processing and storage.*

TPP91005	DERIVATISATION OF FOOD COMPONENTS	2 CREDITS (2-0)

Course Derivatization of Food Components explains the synthesis of new food product components physically, chemically, and enzymatically. This course covers discussions about the physical, chemical, and enzymatic derivatization of starch, celluloses, carbohydrates. The derivatization discussed is physical, chemical, and enzymatic derivatization of lipid, protein, vitamin, bioactive compounds, flavors, and food additives.

Learning Outcome (LO):

1. *Students are able to determine the purpose of the food components derivatizations associated with the application of those components in the processing and formation of characteristics of food.*
2. *Students are able to determine the appropriate methods to do derivatization of food components, including derivatization of starch, carbohydrate, lipids, protein, vitamin, bioactive compounds, flavors, and food additives.*
3. *Students are able to evaluate the application of the derived food components in food processing and its functional on health.*

TPP91006	INNOVATION IN FOOD PROCESSING TECHNOLOGY	2 CREDITS (2-0)

This course covers recent innovation in food processing that has been created/applied in food industries to produce food products with good physical, chemical and sensory qualities, safe, and giving good health for *human health. This course also focuses on studying non-thermal food processing technology, enabling food companies to modify the process to minimize food damage. This technological innovation is aimed at responding to the increasingly growing demands of consumers on the good quality of food.*

Learning Outcome (LO):

1. *Students are able to collect and use information about consumer demands on the quality of food products.*
2. *Students are able to understand the principle/use of the most recent food processing technology in the food industries.*
3. *Students are able to analyze the lack of prior processing technology and modify it with the application of the new food technology to meet consumer demands.*

TPP91007	SENSORY SCIENCE	2 CREDITS (2-0)

This course covers sensory information processing basics to human perceptions of chemical and mechanical stimuli through an integrative neural-sensory perception system. Oral process mechanisms related to sensory perception and expression are also studied to focus on the relations of food materials, the food production process, and the interface between consumers and the food products. The deep review of neurological sensory aspects related to physical, mechanical, chemical, and enzymatic oral processes is also studied to understand the relations between food ingredients and the multimodality of sensory stimuli.

Learning Outcome (LO):

1. *Students are able to understand the physicochemical aspects of food-related to sensory and textural properties during processing and storage.*
2. *Students are able to comprehensively analyze the sensorial perception and consumer behavior related to food product characteristics.*
3. *Students are able to implement the principles of sensory information systems, including its mechanism into sensorial perceptions and expressions for designing innovative food products.*

TPP91008	CAPITA SELECTA FOOD PROCESSING TECHNOLOGY	2 CREDITS (2-0)
This course covers specific topics related to food processing innovation, including thermal processing (drying, pasteurization, sterilization, extrusion) and non-thermal (enzymatic processing, pressure processing, irradiation, etc). The discussion covers some basic concepts in food processing, in-depth discussion of the effect of process on the changes of the raw material characteristics, and the specified product's prediction. This course also studies the modification of the specific process condition and recent development of food processing. ***Learning Outcome (LO):*** 1. *Students are able to analyze the effect of food components on the applied process technology.* 2. *Students are able to analyze changes of the characteristics of food raw materials as an effect of the applied process.* 3. *Students are able to do innovation process-based, based on basic understanding of the food processing.* 4. *Students are able to create specific processes to solve problems in food processing.*		

TPP91009	PRODUCTION TECHNOLOGY OF BIOACTIVE COMPOUNDS	2 CREDITS (2-0)
This course contains an introduction that consists of the definition of biochemical compounds, various bioactive compounds, the sources of bioactive compounds, and their roles in human health. The other topic is the technologies that can be applied to produce bioactive compounds, including physical methods such as the production of resistant starch, sugar alcohols; biological methods such as utilizing microbes to produce metabolites and enzymes; chemical methods; elicitation to the latest methods such as the use of bioreactors to cultivate algae/plant cells or organs to produce bioactive components (in vitro method). Extraction methods and the safety of bioactive compounds are also discussed. ***Learning Outcome (LO):*** 1. *Students are able to understand the definition of the bioactive compounds, their potential development, and the modern consumer preference of this product.* 2. *Students are able to differentiate some bioactive compounds and the sources.*		

3. *Students are able to understand explain the physical and chemical characteristics of bioactive compounds and their role in human health.*

TPP91012	FOOD BIOTECHNOLOGY	2 CREDITS (2-0)
This course contains principles of molecular biotechnology, the influence of biotechnology on the production, processing, and quality of food, biotechnology applications in microbes, plant tissue culture techniques, plant and animal genetic engineering, functional food ingredients and health benefits, biosensors for product monitoring biology, probiotics, enzyme biotechnology, fermented food biotechnology both modern and traditional, food safety issues of recombinant, regulatory and patent products related to transgenic organisms and recombinant products. ***Learning Outcome (LO):*** *Attitude:* *Students have an awareness of the importance of biotechnology, particularly in the field of food concerning the production, processing, quality and regulation of transgenic organisms as well as recombinant products and how their development strategies are for the benefit of humans* *Knowledge:* 1. *Students are able to understand the basic principles of molecular biotechnology.* 2. *Students are able to understand the effects of biotechnology on food production, processing, and quality* 3. *Students are able to integrate the basic concepts of molecular biology and biochemical pathways for food technology applications* 4. *Students are able to discuss technology to produce microorganisms, plants, and animals transgenic* 5. *Students are able to provide insight into biosensors for monitoring biological products* 6. *Students are able to analyze the pathogenicity and control of bacteria and molds of disease-causing pathogens in foodstuffs using biotechnology tools* 7. *Students are able to explore the biotechnology of food fermentation, both modern and traditional, including bioprocessing of food waste* 8. *Students are able to know information about regulatory and patent issues related to transgenic and recombinant products (GMO)*		

TPP91011	FOOD VIROLOGY	2 CREDITS (2-0)

This course contains the structure, types and characteristics and functions of the virus, viral life cycle, viral gene regulation, viral replication, viral infection, isolation and virus detection techniques, viral food-borne illness, bacteriophage, phage applications in food, phage applications in genetic engineering, viral expression system, phage display technology.

Learning Outcome (LO):

Attitude:

Students have awareness of the existence and function of the virus in human life

Knowledge:

1. *Students are able to understand the structure, role, type and characteristics of the virus*
2. *Students are able to understand gene regulation related to viral life cycle*
3. *Students are able to understand the way of isolation and identification of virus type in food product*
4. *Students are able to understand virus detection techniques on food products*
5. *Students are able to explore bacterial virus (bacteriophage) in accordance with the characteristics possessed*
6. *Students are able to know the type of virus that causes foodborne illness*
7. *Students are able to understand the benefits of bacteriophage in the field of food and non food*

TPP91010	ADVANCED FOOD MICROBIOLOGY	2 CREDITS (2-0)

The course explains the relationship between pathogenic microbes and food, environment and host, minimal processing that can prevent pathogenic microbes, pathogenic prevalence, and virulence.

Learning Outcome (LO):

1. *Students are able to explain bacteria and fungal diseases related to food*
2. *Students are able to describe new minimal processing in the food industry*

3. *Students are able to explain bacterial survival strategy* 4. *Students are able to categorize method to detect and identify microbe for assessment quality and food safety* 5. *Students are able to control microbial safety and safety of food product* 6. *Students are able to explain the ecology and physiology of microbes containing in food and digestive tracts* 7. *Students are able to understand comprehensively the virulence and pathogenesis of pathogenic microbes in food and their interaction between environment and host.*

TPP91013	**MICROBIAL TOXICOLOGY**	**2 CREDITS (2-0)**
This course studies microbial toxin, classification of toxin (endotoxin and exotoxin), type of bacterial toxin (neurotoxin, enterotoxin cytotoxin), mycotoxin from fungi and alga. Those kinds of toxin are studied in the aspect of genetic and their ecology. The toxin stability in the food processing, mechanism of action in the body and how to control them in the food are also discussed. ***Learning Outcome (LO):*** 1. *Students are able to explain type of microbes (bacteria, fungi and parasite) producing toxin and their habitat.* 2. *Students are able to explain classification of toxin produced by microbes and their toxin mechanism of action in the human body.* 3. *Students are able to integrate and to think critically of the knowledge obtained from this course to correlate to the current issues of food toxicology* 4. *Students are able to understand the hazard of pathogenic microbes in food and the impact to the increasing of the outbreak cases.* 5. *Students are able to explain toxin stability in the food processing condition and how to prevent their existence in food.*		

TPP91014	**MOLECULAR NUTRITION**	**2 CREDITS (2-0)**
This course discusses the mechanism of nutrient and non-nutrient on biological effect in the human body; knowledge about mechanism at molecular and cell levels, biochemistry process and those effects on cell level which is the center of controlling the health or diseases transcription factor		

on specific food component. Recent techniques used to discover food components' interaction with DNA using in vitro or in vivo are studied. The studies focus on degenerative diseases such as obesity, diabetes, and cancer. Techniques of genomics analysis, such as transcriptomic, proteomics, and metabolomic, used to study molecular nutrition, are also studied.

Learning Outcome (LO):

1. *Students are able to explain the interaction between nutrient and or non-nutrient compounds and DNA and the mechanism driving health and diseases.*
2. *Students are able to explain the concept of research of molecular nutrition.*
3. *Students are able to explain genomics application of transcriptomics, proteomics and metabolomics in molecular nutrition research.*
4. *Students are able to explain recent research about molecular nutrition.*
5. *Students are able to design research about molecular nutrition.*

TPP91015	BIOASSAY TECHNIQUES	2 CREDITS (2-0)

This course discusses some bioassay techniques to test the bioavailability and bioactivity of nutrient compounds (macro and micro-nutrients) and bioactive compounds. The technique methods to be studied are in vitro model including gastrointestinal method, Caco-2 cell model to measure the uptake and transport food components. Other in vitro methods use such as cell line, primer cells from organ body, microsome and S2 fractions, transgenic microbes etc are also studied. In vivo method uses animal model, transgenic animals, feeding method, feed composition. Interpretation of the in vitro results for in vivo situation are also studied.

Learning Outcome (LO):

1. *Students are able to apply testing method of in vitro and in vivo to measure the bioavailability and bioactivity of the food components.*
2. *Students are able to choose appropriate methods to test the bioavailability and biological activity of food components.*
3. *Students are able to correlate in vitro and in vivo results.*

TPP91016	ADVANCED PHYSIOLOGY AND METABOLISM OF NUTRIENTS	2 CREDITS (2-0)

This course discusses about nutrients utilization in the body, covering physiological processes by which nutrients are broken down through digestion, followed by absorption, transport and uptake in the body cell. The discussion will be focused on the regulation of the physiological processes in a more comprehensive way. In addition, the fate of each macronutrient (carbohydrate, fat and protein) in metabolism both catabolism (oxidation) and anabolism (synthesis) will also be discussed. The physiological condition that affect macronutrients utilization for instance to generate energy or to store energy and the body homeostasis to maintain energy balance will be emphasized. Attention to micronutrients metabolism will be given, in particular those related to mineral and vitamin deficiencies. Students must read several publications in this topic to be presented and discuss with other fellow students and lecturers. Publications are selected to those relevant with the research project.

Learning Outcome (LO):

Attitude:

Students have understanding about food consumption behavior and its effect to the human physiology.

Knowledge and problem analytical:

1. *Students know the human physiology and homeostatic and the important concepts related to the nutrition physiology.*
2. *Students know the digestion mechanism and nutrients absorption and the factors affected (food and human physiology).*
3. *Students know the circulation and its correlation with metabolic profiles and biomarkers in the blood associated with the nutrient intake and its determination.*
4. *Students know the system of endocrine in the uptake regulation and nutrient metabolism.*
5. *Students know the mechanism and the uptake regulation in the cell bodies and the factor affected.*
6. *Students know the relationship between central organs that have a role in energy metabolism, protein and micronutrients.*
7. *Students understand the basic metabolism of macronutrients of carbohydrate, protein, and fat in the muscle, liver and/or tissue adipose.*
8. *Students are able to predict metabolic setting based on the changes of composition and bioavailability of macronutrient and to predict the physiology output.*

9. *Students can analyze the food consumption behavior in the real life setting and its effect on the response of the individual physiology and give recommendation for improvement.* 10. *Students can formulate problems and provide a real solution to unhealthy consumption behavior in the form of research ideas aiming to modify macronutrients or micronutrient bioavailability of food/products to produce the desired physiological response.*

TPF92001	**QUALIFICATION EXAMINATION**	**1 credit (1-0)**
Students should prepare a pre-proposal containing her/his research topic that can be done during her/his doctoral research. Qualification examination was performed to evaluate students in theory based-approach, concept of the research, or technical methods to do doctoral research. In this examination, the student must perform her/his competence to do doctoral research to obtain a doctoral degree in Food Science.		

TPF92002	**WRITING PROPOSAL AND SEMINAR**	**2 CREDITS (2-0)**
The student should prepare a research proposal supervised by the promotor and co-promotor, and the proposal is a guide to a dissertation. Promotor and co-promotor should give suggestions to obtain a feasible proposal for the doctoral degree. This process requires thorough discussion with the promotor and co-promotor. The proposal must demonstrate that the candidate is capable of independent scientific research and has good qualities in researching doctoral degrees. After the promotor and co-promotor approve the proposal, the candidate should present it in front of the promotor, co-promotor, and two examiners appointed by the head of the study program.		

TPF91001 TPF92003 TPF91003	**RESEARCH AND PRESENTATION OF RESEARCH PROGRESS 1ST, 2ND AND 3RD**	**6 CREDITS (6-0) x3**
Research and presentation of research progress loads 18 credits, which is divided into 3 term presentations for 6 credits of each term. The presentation is intended to monitor regularly the progress of students' research and scientific publication preparation. Students can do a presentation in front of the promotor and co-promotor or in the scientific meeting in a national or international conference. To do the study program level presentation,		

students should prepare a research progress report and submit it to the promotor and co-promotor before the presentation. To do the presentation at national or international levels, students should submit the journal Manuscript to the promotor and co-promotor to have their approval.		
TPF91002 TPF92004	**INTERNATIONAL PUBLICATION 1ST AND 2ND**	**2 CREDITS (2-0) x2**
The student is required to publish the article in a reputable international journal. The intended reputable journal should be discussed with the promotor and co-promotor. Decree Rector Universitas Brawijaya UB No. 52 2018 regulates the dissertation and scientific publication as a final doctoral study program assignment. To finish the study of the doctoral program, the student must do a) dissertation b) scientific publication Dissertation consists of a) proposal B) proposal presentation c) research d) writing scientific publication e) writing dissertation f) research presentation and g) dissertation defense. Based on that requirements, the Study Program of Doctor in Food Science curriculum is designed based on research and publication in a reputable international journal indexed in Scopus, Thomson Reuters, Microsoft Academic Search, and other journals listed by Universitas Brawijaya. *International scientific publications can be a) two (2) scientific articles published in international journal indexed in Scopus or Web of Science Core Collection (Thomson Reuter), having an impact factor minimum of 0,1 or Microsoft Academic Search; or b) one scientific article as stated in number (a) and one article in a proceeding. Published articles should be based on student research dissertation. One of the published articles should be a student as a first author.*		

TPF92005	**WRITING DISSERTATION AND DEFENSE**	**5 CREDITS (5-0)**
Students must be able to write a dissertation manuscript correctly and be capable of defending her/his dissertation. Before having a defense, students must have at least 2 (two) scientific publications that have been published or accepted for publication.		

5.3.3. DEPARTMENT OF AGROINDUSTRIAL ENGINEERING

The Doctor of Agroindustrial Engineering

TPI91001	PHILOSOPHY OF SCIENCE	2 CREDITS

		(2-0)
The course of Philosophy of Science discusses the definition of Philosophy, Philosophy of Science, Concept of Science, Function of Science, The Role of Philosophy in Science Development, Ontology, Epistemology, Axiology, Tools for Scientific Thinking, Language, Mathematics, Statistics, The strategy to get findings for dissertation based on Philosophy of Science.		

TPI91002	AGROINDUSTRIAL DEVELOPMENT	2 CREDITS (2-0)
The definition and scope of agroindustry, upstream and downstream industry, perspective on agroindustry, agroindustry as a pioneer that is supported by agriculture sector, agroindustry as a key driver of agricultural product export, agroindustry to substitute imported product, Agricultural Demand Led Agroindustry (ADLAI), Agricultural Supply Long-Run Adjustment Mechanism (ASLRAM), The Development of agroindustry as Efficient Economic Structural Transformation (EEST), agroindustry as a driver of rural industrialization, anti-development agroindustry, Some requirements on how the industry is able to act as industrialization drivers in rural areas, Agroindustry investment risk and feasibility study.		

TPI91003	AGROINDUSTRIAL INNOVATION SYSTEM	2 CREDITS (2-0)
The structure of this course consists of several interconnected materials on research, innovation and central and regional innovation institutions, various agroindustry supporting innovation, Technology Readiness Level (TRL) and technology dissemination, and continued to standaridization stage, global and national scale standardization system, innovation product, Intelektual Property (IP) Rights arrangement for the investor.		

TPI91004	INTEGRATED QUALITY SYSTEM	2 CREDITS (2-0)

The course of Integrated Quality System discusses any factors that impact agroindustry product quality, integration of relation between internal and external factors of product quality composition, quality system institution in global and national scale, Indonesian National Standard (SNI) formulation and determination stage, and the latest research development on quality system.

TPI91005	AGROINDUSTRY DOWNSTREAM BIOTECHNOLOGY	2 CREDITS (2-0)
This course covers the connection between a publication and implementation level, scaling up, biorefinery, bioremediation, biotransformation, bioconversion, and how these aspects can be used in the dissertation.		

TPI91006	AGROINDUSTRIAL POLICY STRATEGY	2 CREDITS (2-0)
Agroindustry policy and program strategies, on-farm and off-farm development, investment needs, investment policy support, domestic consumers' price protection policy on imported agroindustry commodities, price control policy to reduce price fluctuation, affordable and soft credit skimming policy for farmer, supervision and quarantine policy on cross boundaries trade traffic, policy of facilities and infrastructure development which support trade operations, incentive assurance policy for the prospect investor.		

TPI91007	DOWNSTREAM PRODUCT TECHNOLOGY	2 CREDITS (2-0)
The course of Downstream Product Technology aims to understand Agroindustrial Biotechnology development through IRL and TKR improves IRL and TKR into downstream product, biotechnology product scale-up, white biotechnology, and biotransformation bioremediation and bioconversion in forming sustainable agroindustry biotechnology product.		

TPI91008	AGRICULTURE TOOLS AND MACHINERY ENGINEERING	3 CREDITS (3-0)
Any Tools and Machinery used to process Agriculture product and the impact in its implementation on the commodity, some examples of any tools utilized in agriculture product industry, any machines used in		

sorting, threshing, distribution, and transportation process.

TPI91009	**INDUSTRIAL WASTE PROCESSING**	**3 CREDITS (3-0)**
This course is about an introduction to industrial; waste processing, physical unit of waste processing (filter, aeration, gas addition, physical precipitation). This course discusses the aerobic treatment by biological processing. The renewable of the wastes is including the activation of sludge and its modification, attachement of growth aerobic process, tricking filters and rotating biological contactors process, anaerob processing, fluidized bed and sludge blanket systems processing, nitrification process, denitrification process, and chemical processing. The chemical processing is including coagulation-flocculation, disinfection, precipitation, adsorption, and ion exchange.		

TPI91010	**CONTROL AND BIOSYSTEM INSTRUMENTATION**	**3 CREDITS (3-0)**
This course contains static and dynamic characteristics of measurement system, sensor and transducer, signal processing, mathematic modeling, control system, transfer function, response analysis, PID control, control system analysis and design, ON-OFF control system, PLC control, Fuzzy control, intelligent control-1, intelligent-2.		

TPI91011	**RENEWABLE ENERGY FOR INDUSTRY**	**3 CREDITS (3-0)**
This course discusses the finding of some renewable energy sources related to solar, wind, and alternative biological energy in depth. The discussion includes technology and performance evaluation principles for those technology components, water, geothermal and other technologies, co-generation, electricity production using wasted heat any financing process related to some issues on alternative energy sources.		

VI. STUDENT AFFAIRS

The student affairs are one of the sub-sections in the Faculty of Agricultural Technology (FTP) organizational structure, University of Brawijaya, under the supervision of the Vice Dean for Student Affairs. The main task of student affairs is to facilitate student service matters, such as scholarship services, graduation services, and to facilitate non-academic learning (soft skills) through the development of various student organizations. In this case, student organizations are formed as a forum for FTP UB students. It will build students to be superior to any achievement of provincial, regional, national and international levels, to be confident to compete on the national and international levels, honest, having integrity, responsible and innovative. Moreover, according to UB's vision and mission to become a world-class entrepreneur university; thus, students should have an entrepreneurial spirit.

6.1. Institute Student Sovereignty at the Faculty of Agricultural Technology (FTP UB)

Student Organizations that exist in the environment of FTP UB are official student organizations and function as forums for developing student activities in the FTP UB environment that the leaders of FTP UB officially recognize its existence. According to Dean Regulation of FTP UB No. 4 of 2020 on Student Development Guidelines Faculty of Agricultural Technology University of Brawijaya, that can be stated the various student organizations in the environment of FTP UB as follow.

1. Student Representative Council hereinafter abbreviated as DPM and Student Consultative Assembly, hereinafter abbreviated as MPM, is a student organization in FTP UB, which has legislative authority and supervision activities. MPM is the highest student institution on the FTP UB level, a forum for FTP students' aspirations. The institution will supervise and accommodate all student organizations at the Faculty level (LKM), consisting of 3 students. Moreover, they are elected by acclamation by their

respective representatives. DPM is a high legislative institution in student life in the FTP environment. DPM functions voicing all students' and academicians' aspirations in FTP UB.

2. Student Executive Board, hereinafter abbreviated as BEM, is a student organization of FTP UB with executive authority to the student organization. Moreover, it has FTP UB students members and aims to accommodate and realize aspiration for FTP UB students. BEM also has functions to support developing and enriching student resources in any discipline of agricultural technology, socioeconomic and politics of Indonesia, and the world. To be active in advocacy of scholarship acceptance, criticizing national and global issues, organizational development, and leadership.
3. Institute Student Sovereignty hereinafter abbreviated ISS is a particular activity unit in FTP UB that accommodates and facilitates potential and creativity in intellectual and science, interest and talent, welfare, entrepreneurship as well as social care, including thinking, exercise, and taste.
4. Agritech Research Study Club, hereinafter abbreviated as ARSC, is LKM, which accommodates intellectual activities by developing competencies in research and scientific work and innovation of FTP UB students.
5. Agritech Sport, hereinafter abbreviated as AS is LKM, which accommodates the activity of sports competency development of FTP UB students.
6. English for Specific Purpose, hereinafter abbreviated as ESP is LKM, which accommodates English skills competency development of FTP UB students.
7. SENI is LKM, which accommodates art competency development of FTP UB students, including sound art, music art, theatrical art, painting, event organizer, photography, and others.
8. TECHNO is LKM which accommodates journalism competency development of FTP UB students.

9. Islamic Studies Forum Agricultural Technology, hereinafter abbreviated as FORKITA is LKM which accommodates Islamic spiritual competency development of FTP UB students.
10. Christian Student Fellowship, hereinafter abbreviated as ERATA, is LKM which accommodates Christian spirituality competency development of FTP UB students.
11. Catholic Student Family, hereinafter abbreviated as KMK, is LKM which accommodates Catholic spirituality competency development of FTP UB students.
12. Agritech Business Center, hereinafter abbreviated as ABC LKM which accommodates entrepreneurship competency development of FTP UB students.
13. Department Student Association, hereinafter abbreviated as HMJ, is a student organization of department level in the FTP UB that accommodates and facilitates potential and creativity in professional and scientific fields according to their field of knowledge.
14. Student Association of Agricultural Product Technology, hereinafter abbreviated as HIMALOGISTA, is HMJ that accommodates students' professional competency in Agricultural Product Technology Department FTP UB.
15. Student Association of Agroindustrial Engineering, hereinafter abbreviated as HIMATITAN, is HMJ that accommodates students' professional competency in Agroindustrial Engineering Department FTP UB.
16. Student Association of Agricultural Engineering, hereinafter abbreviated HIMATETA, accommodates students' professional competency in the Agricultural Engineering Department FTP UB.

6.2. Introduction to Campus Life for New Students (PK2-MABA)

According to Regulation of the Rector No. 44 of 2018 concerning the implementation guide of Introduction to Campus Life, the vision of PK2-MABA is as means of student awareness and adaptability as qualified members of the scientific community and future generations, being fastener to unity and togetherness, as well as developing student's critical and analytical culture. The mission of PK2-MABA is to form students with high integrity who prioritize intellectuality and uphold moral and religious values and develop a student mindset that is critical, innovative, dynamic, and sensitive to social dynamics. PK2-MABA has a general purpose of introducing campus life for new students to adapt to various college activities easier, both academic and non-academic activities. Furthermore, it is a mandatory activity for new students consisting of preparatory activity, Educational Orientation (Ordik), Student Orientation (Ormawa).

According to Regulation of the Rector UB No. 44 of 2018 concerning the implementation guide of Introduction to Campus Life, new students who do not attend/ not pass the PK2-MABA, subject to sanctions in the form of:

1. Unable to become members and administrators of a student organization in FTP and UB;
2. Unable to obtain scholarship facilities; and
3. Unable to take the final undergraduate exam (thesis examination).

6.3. The Most Outstanding Student (MAWAPRES)

The most outstanding student (MAWAPRES) election is held every year by selecting accurate filing conducted by the jury team, and it is expected to the winner to pass the selection of the most outstanding students at the level of Universitas Brawijaya and national as well. MAWAPRES selection is carried out at the department level; then, the final determination is carried out at the Faculty level. The faculty subsequently provides the name MAWAPRES, which will be submitted to the university level.

The election of MAWAPRES may be participated by a maximum of 6 semesters students. Implementation procedure includes: a) Registration and filling out the form; b) File collection; c) File verification by student subdivision; d) Recap file registration; e) Election of the most outstanding students f) File submission to the university.

6.4. Student Code of Ethics

The Code of Ethics is prepared to provide all FTP UB students guidelines for good behavior, integrity, reputation, and noble character in carrying out activities in the FTP UB environment and the community. The Code of Ethics's implementation is a mutual commitment of FTP UB students to realize the vision, mission, and purpose of FTP UB and promote FTP UB as one of the units with Integrity Zone (IZ). Furthermore, it is intended to form pious, knowledgeable, reputable, virtuous students with integrity and a noble character; create an orderly, regularly, integrity, and reputable in the conducive academic and non-academic education process in a conducive academic and non-academic/student affair climate. Moreover, it shapes students' character to be disciplined, ethical, integrity, reputable, and obedient to legal norms, religious norms, and other norms lying in society.

The advantages of the Code of Ethics are:

1. Creating a conducive academic and student learning climate that expedites the achievement of the vision, mission, and purpose of FTP UB;
2. Creating FTP UB as Integrity Zone (IZ);
3. Increasing satisfaction of students, lecturers, education staffs, and stakeholders of FTP, including the family of FTP UB students;
4. Human resources are of good quality, disciplined, having integrity, reputable, and virtuous.

Good standard behaviour

Good standard behavior reflects high morals, integrity, reputation, and obedience to ethical norms that lie in society and religion, including:

1. Believe in The One Almighty God according to the religion and belief;
2. Appreciate science, technology, literature, and the arts;
3. Uphold the national culture;

4. Maintain authority, reputation, integrity, and honor of FTP UB;
5. To actively participate in maintaining facilities and infrastructure, environmental hygiene, convenience, order, and safety in the FTP UB environment;
6. Maintain personal integrity and reputation as members of FTP UB;
7. Abide by the applicable regulations and rules of FTP UB;
8. Dress modesty, neat, cleanly, fragrant (not wearing sandals, T-shirts, tight and revealing clothing);
9. Behave good to others, maintain right words, not commit to sexual harassment, have boundaries with the opposite sex (male and female relationship) following societal and religious norms;
10. Not smoking anywhere but in the places provided;
11. Respect others regardless of ethnicity, religion, race, and social status;
12. Abide legal norms, religious norms, and other norms that lie in society;
13. Respect others opinions and prioritize deliberation;
14. Responsible for all good deeds both in real life and social media use;
15. Avoiding actions that are useless and/or contrary to the legal norms, religious norms, and other norms that lie in the society;
16. Not committing to bullying and intimidation of others either directly or indirectly through print media and online social media;
17. Not cheating and deceive both in academic and non-academic matters;
18. Prioritize collective interests over personal or group interests/Put collective interest ahead of individual or group interest;
19. Promote intellectual and scientific logic-based thinking without compelling personal or group will;
20. Maintain the integrity and reputation of FTP UB.
21. Not spreading the ideas prohibited by legal norms, religious norms, or societal norms to others, such as communism, atheism

(not believing in God Almighty), LGBT (lesbian, gay, bisexual, and transgender), radicalism, and others;

22. Not spreading fake news/hoax which may harm others;
23. Not inciting others to do the disgraceful act;
24. Always undertake taking care of yourself and others, such as to use standard-compliant medical devices (mask or face shield) and keep yourself at a distance from others if you are not in good health.

Student Standard behavior in the lecture rooms and laboratories:

1. Attend in time, before the lecturer entering the lecture rooms or laboratories;
2. Dress modesty, neat, cleanly and fragrant–will never deviate from the principle of propriety;
3. Respect other students by not committing to disturbing act to lectures such as using gadgets or other electronic devices during the class, worst sitting positions that interfere with other students, and other activities that disturb the concentration and serenity of other students;
4. Not smoking anywhere but in the particular places provided;
5. Expressing opinions or arguing against opinions politely, to more put intellectual and scientific logic thinking ahead in expressing opinions;
6. Not uttering inappropriate and hurtful words to others;
7. Honest, not signing the attendance of other students she/he knows do not attend in the lectures, and to not cheat in doing assignments and exams;
8. Maintain inventories of lecture halls or laboratories;
9. Not taking actions that can cause danger while in the laboratory without the guidance of lecturers or laboratory staffs;
10. Not joking/kidding during lectures/practicum in the lecture room or the laboratory;
11. Not messing rooms and inventories of laboratories in FTP UB such as littering, scribbling tables, chairs, and room walls;

12. Abide by the rules provided in every laboratory in FTP UB environment;
13. Use standard-compliant medical devices (mask or face shield) and keep yourself at a distance from others in the lecture rooms or laboratories if you are not in good health;
14. Restore the laboratory equipment/apparatus to its place in a clean and undamaged condition;
15. Maintain the integrity of the lecture room and laboratory services.

Student ethics to do assignments, research report of undergraduate thesis, postgraduate thesis, and dissertation:

1. Submit assignments/reports in time;
2. Honest means not plagiarizing or using other students' assignments/reports;
3. Not attempting to influence the lecturer so that they do not submit assignments/ reports in return for any form and name of reward;
4. Abide by scientific ethics in writing the undergraduate thesis/postgraduate thesis/ dissertation, for instance, complying with the provisions and procedures for writing; attending/following the advisory well; cheating other people's work (plagiarism).
5. Not promising to provide the amount of money or other facilities to the lecturers or other parties to influence the process of assignments/reports, undergraduate thesis/postgraduate thesis/dissertation;
6. Doing entire assignments, research reports, undergraduate thesis/postgraduate thesis/dissertation by their ability and not asking others or paying consultant service to do so;
7. Maintain integrity to set out assignments, research reports, and undergraduate thesis/postgraduate thesis/dissertation.

Student ethics to take the examination:

1. Abide by examination rules set by FTP UB;

2. Honest and having good manner, not opening books or other sources which is not allowed to carry out, but those who are otherwise allowed to do so;
3. Not disturbing the concentration of other students who are taking examinations;
4. Not scribbling inventories of FTP UB, i.e., table, chair, the wall in the wrong manner to ease answering the examination;
5. Not promising to provide the amount of money or other facilities to lecturers or other parties to influence the examination process and result.
6. Believe in own capabilities, not utilizing others' influence to aim affecting process and result of examination;
7. Not cheating in the examination;
8. Maintain integrity while taking an examination.

Student ethics to the lecturers and education staffs:

1. Respecting to all lecturers and education staffs regardless of ethnicity, religion, race, and like or dislike ;
2. Behaving and communicating politely to all lecturers and education staffs in interaction whether within or outside the FTP UB environment;
3. Maintaining the excellent reputation of lecturers and academicians as well as their family;
4. Not spreading lousy information with doubtful validity about a lecturer or education staffs to other parties, except those who breach the obligatory law and ethics according to the regulation and direction in the FTP UB environment;
5. Express the opinions politely or argue ideas regarding discipline along with rational and scientific argument;
6. Honest to the lecturers and education staffs over all aspects;
7. Not promising to provide the amount of money or other facilities to lecturers to influence lecturer assessment;
8. Believing in their ability, not using others' influence to govern the lecturer assessment;

9. Not threatening either directly or by using other people to lecturers and education staffs;
10. Collaborating with lecturers and education staffs in achieving learning objectives, which cover preparing themselves before interacting with the lecturer in the lecture room;
11. Maintaining politeness during an academic appeal over lecturer and education staffs attitude to the leaders along with sufficient evidence;
12. Avoiding hate and other disgraceful attitudes towards lecturers for the score given by lecturers;
13. Abiding lecturers' order and guidance as long as they do not contradict the legal norms and other norms that lie in the society;
14. Brave to be responsible for all actions regarding the interaction with lecturer and education staffs;
15. Not committing to bullying towards lecturers and education staffs both directly and through print media or online social media;
16. Not inciting and bring lecturers and academics into conflict with one another;

Ethics between students:

1. Respecting to all students regardless of ethnicity, religion, race and like or dislike;
2. Behaving and communicating politely to all students to interact either within or outside the FTP UB environment;
3. Collaborating appropriately with other students in studying science by not imposing personal ego;
4. Having strong solidarity and help each other for a good cause and not contradicting to legal, religious, or other norms that lie in the society;
5. Fair to fellow students;
6. Avoiding words that hurt other students' feeling;
7. Not threatening or committing an act of violence to fellow students either within or outside the FTP UB environment;
8. Advising each other for a good cause;

9. Having a helpful attitude to other students who are both less capable in lessons and less well economically;
10. Maintaining together the integrity, reputation, honor of FTP UB, and not committing disgraceful actions that damage the good image of FTP UB;
11. Respecting dissents or differences in views to other students, as well as put intellectual, logical thinking based discussion ahead to avoid imposing/coerce opinions on others;
12. Not disturbing the serenity of other students who are following the learning process;
13. Not incite or conspire with others to commit disgraceful acts which breach legal, religious, and other norms that lie in the society;
14. Maintaining interaction between the opposite sex (male and female relationship) following the applicable societal and religious norms and not committing disgraceful acts regarding male and female interaction;
15. Not spreading ideas/concept/belief that is prohibited by legal norms, religious norms, or societal norms to other students (i.e., communist, LGBT (lesbian, gay, bisexual, and transgender), atheists (do not believe in God Almighty), radicalism, and others);
16. Not committing to bullying and intimidation to other students both directly and indirectly through print media or online social media;
17. Not exploiting other students for personal or group interests;
18. Not spreading fake news (*hoax*) regarding other students on various social media;
19. Maintaining personal integrity and reputation of students of FTP UB.

Student ethics to society:

1. Committing the goodwill which elevates integrity, reputation, and honor of FTP UB in the society;
2. Having a helpful attitude to society according to their discipline;

3. Avoiding behaviors that breach the norms lie in the society either legal norms, religious norms, decency norms, and propriety norms;
4. Engaging society to commit goodwill otherwise not committing to disgraceful acts;
5. Abide legal norms, religious norms, societal norms which is applicable in the neighborhood;
6. Setting goodwill and behavior with integrity in society.

Code of Ethics Disciplinary

To report any breach of the Code of Ethics for every academic community is obligatory. Moreover, they must prevent any occurrence of the Code of Ethics breach. The leaders of FTP UB have likewise to protect the informant's identity. Every violation may be subject to disciplinary action by FTP UB leaders. After obtaining other parties' opinions who find it out, Dean is able to reconsider its more massive disciplinary action to the Code of Ethics breach.

The disciplinary actions to the Code of Ethics breach are in the form of reprimands, stern warnings, cancellation of course grades for one semester, cancellation of PKL (Field Practice)/KKN (Community Service Program), or final assignments, suspension within a certain period, and being expelled from UB. Every violator of the Code of Ethics is given the right to defend himself/herself. However, no later than one week after the violation's notification is submitted to the person concerned. Furthermore, the violator of the Code of Ethics receives written information from the FTP UB leaders.

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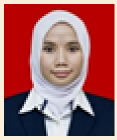

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