# Annex No. 4 to Resolution No. 88 of the Council of the Faculty of Environmental Management and Agriculture of 30 March 2017 on plans of study and curricula

**CURRICULUM**

Main field of study: Agriculture

Specialty: Production Management

Type and level of program: second-degree program

Enrollment status: full-time

Educational profile of the program: general academic

Duration: 3 semesters

1. **GENERAL REQUIREMENTS**

# Advanced Information Technologies

*Educational objectives:* Students learn about practical applications of computer software in various fields of agriculture. They learn to use specialist software and IT tools, including image analysis, statistical analysis and satellite techniques to support the operations of farms and rural municipalities.

*Course Content – Classes:* Statistical analyses of research results presented in Master’s theses with the use of Excel spreadsheets and the Statistica software package. Planning and organizing agricultural production in the Agronom program. Cytological analyses – using custom software to register and analyze cytological data. Gene mapping – using custom software to determine gene sequences genes in chromosomes and the distance between genes. Transforming color space models in the Corel computer graphics program. Designing recreational areas in the 3D Wymarzony ogród program. Comprehensive support for crop production – analyses for registration purposes, statements of costs and expenses, fertilizing balance – in the eLMID-AgrarGIS program.

*Learning Outcomes*

*Knowledge:* The student uses computer software to perform statistical analyses of research data. The student has knowledge of scientific experiments and is able to process research results with the use of IT tools.

*Skills:* The student applies IT tools to acquire and process data from agricultural production systems. The student uses IT tools to present the processed information. The student uses advanced IT tools to acquire data, perform calculations, interpret and present the results.

*Social Skills:* The student recognizes the importance of lifelong learning and self-improvement for professional attainment in the field of information technology.

1. **Foreign Language**

*Educational objectives*: Students develop foreign language competency that enables them to understand, translate and use specialist vocabulary in a given field of study at B2+ level according to the Common European Framework of Reference for Languages.

*Course Content – Classes:* During the course, student learn vocabulary and grammar, including selected elements of specialist language, that will enable them to communicate in a foreign language; analysis of scientific texts, discussions, language exercises, translating texts, presenting various learning techniques, encouraging self-assessment, identification and formulation of linguistic rules, various methods of instruction (individual, in pairs, in groups), selection of exercises that are best adapted to the student’s ability and personality.

# Subject taught as part of the general academic module - humanities

*Educational objectives*: Students are introduced to the humanities and the problems tackled by this academic discipline. They are encouraged to formulate open questions and analyze diverse points of view. Students learn basic terminology and become familiar with the terminology, assumptions and consequences of the formulated theories and points of view.

*Course Content:* Students are encouraged to acquire additional knowledge, skills and social skills in the chosen general academic subject in the humanities.

1. **Development Economics**

*Educational objectives*: Students acquire rudimentary knowledge about sustainable and multi-functional development, determinants of economic growth and the growth of various sectors of the economy.

*Course Content – Lectures*: Development economics as an academic discipline. Determinants of economic growth and development. Indicators of economic growth. Economic dualism in the contemporary world. Characteristic features of highly developed, developing and underdeveloped countries. Production factors and their role in economic growth. Sustainable and multi-functional development. Theories of economic growth. Determinants of and barriers to economic growth. Models of economic growth. Regional variations in development in Poland. Urbanization and industrialization. Development of agriculture in the world. Debt and public debt. Financing agricultural development. Poverty and social exclusion. Knowledge as a prerequisite for economic growth. The role of the state in social and economic development.

*Learning Outcomes*

*Knowledge*: The student has knowledge of development economy and management. The student has sufficient knowledge to analyze social and economic processes. The student has the necessary knowledge to undertake research.

*Skills*: The student is familiar with the determinants of economic growth. The student relies on various sources of knowledge to analyze social and economic development.

*Social Skills*: The student participates in discussions on social and economic development.

1. **Economic Policy**

*Educational objectives*: Students learn about the concepts and mechanisms of economic policy in various systems, in particular in open markets, to further their understanding of the key problems in economic management. Rational and effective economic policies introduced by central governments, public institutions and international organizations to improve social welfare. Economic policies do not compete with market mechanisms, but are introduced as a complementary measure.

*Course Content – Lectures:* Introduction to economic policy – functions, economic systems, determinants, goals and fields. Entities influenced by economic policy, social preferences. History of economic policy – doctrines, systems, trends. Market failure. Economic development policy – sustainable growth, development strategies. Introduction of economic planning and forecasting. Structural policy. Industrial policy. Food policy. Regional policy. Environmental protection policy. Science and innovation policy. Investment policy. Regulatory mechanisms – monetary policy, budgetary policy, labor market regulation, income and price regulation. Foreign policy. Social policy.

*Learning Outcomes*:

*Knowledge:* The student is familiar with the main trends in economic theory relating to economic growth and regulatory mechanisms in economic policy. The student explains the role of the state in managing economic processes. The student is familiar with social and economic processes in the national economy.

*Skills:* The student is familiar with the main concepts and mechanisms of economic policy, social and economic phenomena and processes.

*Social Skills:* The student adopts a rational and cautious approach in analyses of social and economic processes.

1. **Physical Education**

*Educational objectives*: Students learn about the influence of physical activity on the human body, activities that promote health and fitness, and the correlations between age, health, physical activity and motor ability of men and women. Students develop physical skills in the studied sports disciplines and use them to organize recreational activities.

*Course Content – Classes*: Students acquire and master technical and tactical skills in the chosen sports disciplines: volleyball, soccer, basketball, badminton, table tennis, tennis, unihockey, gymnastics, aerobics and bodybuilding. Track and field, cycling, kayaking, ice skating, Alpine skiing, swimming. Fitness training. Students learn the rules of various sports discipline and learn about the health benefits of exercise. Students learn to organize various forms of active recreation. Students train in the sports facilities of the University of Warmia and Mazury and in training camps.

*Learning Outcomes*:

*Social Skills:* The student effectively cooperates and communicates with team members. The student assumes responsibility for task performance. Field leaders are usually leaders in other areas of life.

**II. CORE COURSE UNITS**

* + - 1. **Instrumental Analysis**

*Educational objectives*: Students acquire theoretical knowledge about modern instrumental techniques for quantitative analyses of plants, soil and horticultural substrates. They conduct quantitative analyses of chemical elements and compounds in the examined material with the use of basic instrumental techniques.

*Course Content – Lectures:* Modern techniques of instrumental analysis – methods and selection criteria. Introduction to emission spectrometry and atomic absorption spectrometry (AAS). The use of AAS and flame photometry in quantitative analyses of chemical elements. UV-Vis and IR spectrophotometry – fundamentals, practical applications and description of a UV-Vis spectrophotometer. Nephelometry and turbidimetry – fundamentals and practical applications, description of a nephlometer and turbidimeter, principles of quantitative analysis in turbidimetry and nephelometry. Potentiometry – fundamentals and practical applications, classification and operating principles of electrodes. Conductometry – fundamentals and practical application, description of conductometric devices. Classification of chromatographic methods, introduction to gas, liquid and thin-layer chromatography. Classification of errors and methods of evaluating analytical results.

*Course Content – Classes*: Determination of calcium and potassium concentrations in plant tissues and soil by flame photometry. Operating a flame photometer. Determination of element concentrations in plant tissues and soil by atomic absorption spectrometry. Preparation of standard solutions and standard curves. Operating an atomic absorption spectrometer. Determination of phosphorus concentration in plant tissues by UV-Vis spectrophotometry. Preparation of standard solutions and standard curves. Operating a UV-Vis spectrophotometer. Turbidimetric determination of sulfur concentration in plant tissues. Potentiometric determination of chloride and nitrite ion concentrations in horticultural substrates and water. Determination of electrolytic conductivity and salinification of horticultural substrates, sewage and surface water. Determination of the concentrations of polycyclic aromatic hydrocarbons in soil by gas chromatography.

*Learning Outcomes*

*Knowledge:* The student explains physical and physicochemical phenomena analyzed with the use of various instrumental methods. The student is familiar with the operating principles of modern analytical instruments presented in class. The student describes the presented instrumental techniques and can use them in chemical analyses of plant and soil samples.

*Skills*: The student operates basic measuring equipment. The student performs quantitative analyses of plant and soil samples with the use of the appropriate instrumental methods. The student prepares samples, develops calibration curves, processes and interprets the results.

*Social Skills*: The student takes responsibility for the results of chemical analyses and the used laboratory equipment. The student observes health and safety regulations applicable to laboratory work. The student recognizes the need for continuous improvement of his/her qualifications in a given area of professional activity.

* + - 1. **Physical Properties of Soil and Agricultural Raw Materials**

*Educational objectives*: Students learn methods of measuring the physical properties of soil and the balance between soil water and soil air. Students learn methods of analyzing agricultural raw materials. Students learn about the influence of soil minerals, soil fractions and soil composition (solid, liquid and gas phase) on soil properties and processes.

*Course Content – Classes*: Determination of the physical parameters of soil (solid phase density, volumetric density, total and differential porosity, plasticity, consistency) in a laboratory. Field analysis of soil compactness. Determination of water retention and hydraulic conductivity (potential and effective water retention and capillary action). Determination of the hydrophobic properties of soil. Determination of soil redox potential. Measuring the size of soil fractions. Laser diffraction analyses of agricultural raw materials.

*Learning Outcomes*

*Knowledge*: The student has extensive knowledge of physics, mathematics and soil science. The student describes the influence of solid phase composition and soil’s water and air balance on soil processes. The student is familiar with the methods of measuring the physical properties of soil, soil water and air content.

*Skills:* The student samples and analyzes soil and plant specimens. The student determines the physical parameters of soil, soil water content and the geometric parameters of agricultural raw materials. The student interprets water retention curves (pF) and indicators of soil aeration status. The student gathers and analyzes experimental data. The student presents experimental results with the use of various communication channels.

*Social Skills:* The student understands the significance of soil’s water retention potential for water resource management. The student is familiar with technological progress and its impact on the quality of agricultural produce. The student understands that the physical properties of soil and the balance between soil water and soil air influence soil processes. The student is open to new technological solutions that increase crop output and improve the quality of agricultural produce.

**III. COURSE UNITS RELATED TO THE FIELD OF STUDY**

1. **Agricultural management**

*Educational objectives*: Students become familiar with different aspects of agricultural management and learn to organize work in a farm.

*Course Content – Lectures*: Basic concepts and principles of work organization. Organizational methods. Organizing group work. Regulating work time. Calculating remuneration. Organizing production systems. Types of production systems. Organizing work stations. Ergonomics. Productivity. Work management. Controlling the quality of agricultural produce. Optimizing storage, transport, packaging, handling and sales. Logistics systems in agriculture.

*Course Content – Classes*: Organizing work in a production process. Organizing work stations. Analyzing work methods and working time. Calculating productivity and work quality. Employee assessment. Rationalization of work processes. Work time tracking. Human resources management.

*Learning Outcomes*

*Knowledge:* The student is familiar with the basic principles of work organization. The student understands the specific work requirements in agriculture.

*Skills:* The student analyzes various work methods and selects a solution that is optimal for the given environment. The student uses the learned methods to analyze work progress.

*Social Skills*: The student actively searches for innovative solutions to work organization problems. The student is aware of the limitations of social capital and human resources.

# Technological Progress

*Educational objectives*: Students learn methods of quantifying technological progress (technical, chemical, organizational, etc.) in agriculture.

*Course Content – Lectures*: Changes in the global structure of agricultural production. Technological progress as the combined output of technical, biological and chemical progress, changes in agrarian structure and social factors. Feedback between technical, biological and chemical progress. Effectiveness of technical progress. Progress in agricultural chemistry, changes in the structure of expenditures on industrial and non-industrial means of production, including fertilizers and crop protection agents. Crop protection in Poland and other countries. Effectiveness of changes in agrarian structure. Organizational progress in agriculture.

*Course Content – Classes*: Innovative solutions in soil cultivation, seeding, potato planting and crop protection. Equipment for the maintenance of green areas. Tools and implements for small-scale tractors used in horticulture and forestry. Decision-support methods in crop protection.

*Learning Outcomes*:

*Knowledge*: The student has knowledge of advanced technologies and tools used in agriculture. The student is familiar with technical solutions in contemporary agriculture.

*Skills*: The student identifies solutions that increase agricultural output and profits based on the existing environmental and technical factors. The student plans technological processes relating to agricultural production based on expert knowledge and specialist skills.

*Social Skills*: The student identifies and solves professional problems. The student is aware of his/her professional liability.

1. **Statistics and Experimentation**

*Educational objectives*: Students acquire knowledge of statistics. They learn to plan research studies in agriculture and to analyze the results with the use of statistical inference methods.

*Course Content – Lectures*: Probability theory and its application in research. Descriptive statistics in agricultural experimentation. Discrete random variable. Continuous random variable. Normal distribution – standardization. Point and interval estimates. Statistical inference. Statistical hypothesis. Significance test. Modeling agricultural phenomena. Analysis of variance. Randomized experimental design and randomized block design – theory. Two factor experiments – theory. Correlation and linear regression. Multiple regression models. Chi-square test. Non-parametric tests.

*Course Content – Classes*: Probability theory. Statistical analysis of sample data. Binomial and Poisson distribution. Normal distribution. Standardization of variables. Statistical inference. Testing differences between means. One-way analysis of variance (ANOVA). Regression and correlation. Chi-square test.

*Learning Outcomes*

*Knowledge*: The student has extensive knowledge of mathematical statistics and uses basic statistical methods to process data from agricultural experiments.

*Skills*: The student independently plans, conducts, analyzes and evaluates agricultural experiments, correctly interprets results and draws conclusions.

*Social Skills*: The student independently plans and performs agricultural operations.

1. **Agrobiotechnologies**

*Educational objectives:* Students acquire knowledge of agricultural biotechnology, *in vitro* propagation of plant tissues, methods of producing transgenic plants and their practical application in Poland and other countries.

*Course Content – Lectures*: Biotechnology and its contribution to progress in biology. Introduction to *in vitro* propagation of plant tissues: totipotency and morphogenetic potential of plant cells, types of explant cultures, donors of explant tissue, establishment and conditions of *in vitro* cultures. Growth regulators and their role in *in vitro* cultures of plant tissues. *In vitro* micropropagation – methods and description. *In vitro* propagation of haploid plants. Concept and classification of haploids. The use of haploids in genetic research and breeding. *In vitro* cultures in distant hybridization – cultures of immature hybrid embryos, culture and fusion of plant protoplasts. Production of transgenic plants – genetic engineering, prospects. Biological synthesis of secondary metabolites and other organic substances.

*Course Content – Classes*: Laboratory safety – working with sterile plant material and chemical reagents. Preparing, sterilizing and dispensing culture media. Sampling and sterilization of plant material. Establishing *in vitro* cultures: preparation of explant tissues, placement on culture media and protection. The influence of the concentration of chemical sterilization agents and exposure time on different types of explant tissue. *In vitro* micropropagation of various types of explant tissues by organogenesis and somatic embryogenesis. The influence of light on shoot and root organogenesis and somatic embryogenesis. The influence of growth regulators on adventitious shoots, calluses and organogenesis.

*Learning Outcomes*:

*Knowledge:* The student has extensive knowledge of biochemistry, genetics and biotechnology in the field of agriculture. The student demonstrates in-depth knowledge of genetic factors in plant tissue cultures and the functioning of organisms and organs in artificial environments. The student is familiar with specialist agrobiotechnological techniques and knows how to apply them in practice to improve the quality of life.

*Skills*: The student effectively searches for agrobiotechnology data and applies them in practice. The student independently establishes biotechnological experiments and analyzes the results. The student prepares and reports on biotechnology projects. The student comprehensively analyzes problems that affect food output and food quality in biotechnology systems, human and animal health, and the environment.

*Social Skills*: The student assumes social, professional and ethical responsibility for the production of high-quality food and the state of the natural environment. The student recognizes the need for lifelong learning.

# Soil Biochemistry

*Educational objectives*: Students learn about the basic biochemical processes in the soil environment and the methods of determining the activity of selected soil enzymes.

*Course Content – Classes*: Basic biochemical processes in the soil environment. Specification of soil enzymes. The importance of organic matter synthesis and decomposition in soil. The significance of redox processes in soil fertility. The role of enzymes in nitrification and denitrification. Preparation of soil samples for enzyme activity analyses. The role of selected enzymes in soil metabolism. Determination of the nitrification potential of soil. Determination of soil fertility based on enzyme activity levels. Biochemical indicators of soil quality.

*Learning Outcomes*:

*Knowledge*: The student draws correct conclusions from biochemical soil analyses. The student identifies enzymes involved in carbon, nitrogen, sulfur and phosphorus metabolism.

*Skills*: The student develops simple biochemical indicators of soil fertility. The student analyzes enzyme activity and biochemical processes.

*Social Skills*: The student recognizes the importance of biochemical analyses in evaluations of soil quality. The student conducts biochemical analyses of soil independently and in a team effort.

# Certified Crop Production Technologies

*Educational objectives*: Students learn to evaluate various crop production technologies by analyzing their effectiveness.

*Course Content – Lectures*: Factors that influence technological processes in crop production. The relationship between agricultural inputs and technology. Quantitative and qualitative elements of production technology, comprehensive crop production systems. Technological progress and its determinants. Agronomic (primary and secondary crops, crop quality, efficiency of agricultural inputs, etc.) evaluations of various production technologies. Energy efficiency of high-input and low-input crop production systems. Economic efficiency of various cropping systems. Environmental impacts of different production technologies.

*Course Content – Classes*: Comparative analysis of economic efficiency and energy efficiency of low-input and high-input cereal production systems. Comparative analysis of economic efficiency and energy efficiency of low-input and high-input legume production systems. Comparative analysis of economic efficiency and energy efficiency of low-input and high-input industrial crop production systems

*Learning Outcomes*:

*Knowledge*: The student identifies the relationships between production inputs and agricultural technology. The student is familiar with the correlations between production technology and crop productivity. The student identifies the links between quantitative and qualitative aspects of agricultural production technology vs. productivity and economic efficiency. The student is familiar with the environmental threats associated with agricultural production.

*Skills*: The student designs, evaluates and selects optimal crop production methods. The student compares the efficiency of selected crop production systems. The student analyzes the economic efficiency of individual operations and entire crop production systems.

*Social Skills*: The student recognizes the importance of planning and organizing crop production processes in farms. The student creatively plans crop production technologies based on the available resources and environmental impacts. The student values team work in agricultural projects.

# Elements of Bioinformatics in Molecular Phytopathology

*Educational objectives*: Students acquire a fundamental knowledge of bioinformatics and phylogenetics of pathogenic microorganisms. Presentations of biological databases (genes, genomes). Students are introduced to software for developing phylogenetic trees. They learn to analyze and interpret the results.

*Course Content – Classes*: The concept and goal of bioinformatics. DNA barcoding. Characterization of genomes and genes for identifying animals, plants and fungi (mitochondrial, plastid and nuclear genomes). Introduction to phylogenetics. NCBI – biological database, practical uses. Analysis and comparison of genomes. BLAST analyses. Generation of phylogenetic trees in the DNAMAN program and analyses of evolutionary relationships between organisms on the example of Gene Bank sequences. Presentation and practical application of websites dedicated to the epidemiology of crop pathogens.

*Learning Outcomes:*

*Knowledge*: The student has extensive knowledge of molecular biology, phytopathology and plant pathogens. The student has rudimentary knowledge of phylogenetics and bioinformatics. The student is familiar with advanced tools and techniques in molecular biology (PCR analyses, DNA sequencing), phylogenetics and bioinformatics. The student understands the significance of organisms and their evolutionary relationships based on genetic variation.

*Skills*: The student searches for, analyzes and creatively uses data in the fields of bioinformatics and phylogenetics of living organisms. The student selects the appropriate data processing methods with the use of NCBI databases. The student searches for DNA sequences of various genes, is familiar with the methods of generating phylogenetic trees and identifies different types of trees. The student generates and evaluates phylogenetic trees and analyzes evolutionary relatedness between organisms (taxa).

*Social Skills*: The student recognizes the need to continually expanding his/her knowledge of new technologies in molecular biology and bioinformatics. The student analyzes research tasks and formulates conclusions.

# Protection and Management of Agricultural Ecosystems

*Educational objectives*: Students learn about changes in agroecosystems and agricultural landscapes resulting from anthropogenic pressure.

*Course Content – Lectures*: Basic concepts and definitions of nature and the environment. Factors and processes responsible for environmental change. The agricultural landscape and its components. Progress in agriculture and its influence on the agricultural landscape; loss of natural habitats and biological diversity. Soil degradation caused by non-agricultural (mechanical, hydrological, physical, chemical, thermal, etc.) and agricultural factors (acidification, weed propagation, loss of humus, mechanical degradation caused by compaction, chemical contamination due to incorrect use of fertilizers and pesticides, disrupted water relations, aridification, etc.), land protection and reclamation.

*Course Content – Classes*: Students rely on the literature and the acquired knowledge to deliver presentations about the influence of abiotic and biotic factors on the agricultural environment, forecasts for the future and protective measures. Students learn about legal regulations relating to environmental management and protection (laws regulating environmental protection, nature conservation, fertilization, organic farming, etc.). Conflict between intensive farming and the preservation of agroecosystems and adjacent ecosystems (aquatic ecosystems, forests). The field-forest boundary and damage caused by hunting.

*Learning Outcomes*:

*Knowledge*: The student has extensive knowledge of change processes in agroecosystems. The student identifies the threats associated with intensive farming. The student identifies the causes, magnitude and consequences of human activities on ecological systems and ecosystem diversity.

*Skills*: The student searches for, understands and uses information on agroecosystem management and protection. The student analyzes various phenomena in ecological systems and evaluates their influence on crop output and crop quality.

*Social Skills*: The student recognizes the importance of agroecosystem management and protection in agricultural practice (field crop production, grassland management). The student understands and assumes responsibility for the present and future state of the agricultural environment. The student puts theoretical knowledge to practice in agricultural production.

1. **Quality of Agricultural Produce and Food Safety**

*Educational objectives*: Students learn about the relations between the elements of the food chain and legal regulations concerning food safety (“from farm to fork”). Principles and procedures of food safety systems in Poland. The significance of food quality for economic efficiency.

*Course Content – Lectures*: Crop yield and crop quality. Factors that determine the nutritional value of crops in the production of foods and feeds and the processing suitability of crops for industrial applications. Contamination of agricultural produce. Legal regulations relating to food and feed safety. Monitoring, risk assessment, toxicology analyses, determination of maximum residue levels (MRL) in food and feed. Good Agricultural Practices (GAP) for eliminating and minimizing contamination in agricultural produce. Physical availability, economic availability and quality as determinants of food safety. Basic food safety principles in agribusiness. The significance of food quality for the agricultural market. The functions, features and procedures of implementing food quality systems in agriculture.

*Course Content – Classes*: Selected legal acts regulating food and feed safety. Major sources of food contamination and their impact on human health. Genotoxic and carcinogenic substances. Genetically modified foods and feeds in the EU. Labeling of products containing GMOs. Food terrorism. The main organizational aspects that influence food safety. Good practices in primary production. Students draft regulations relating to quality certification of selected food groups.

*Learning Outcomes*:

*Knowledge:* The student has extensive knowledge about the quality and contamination of agricultural produce. The student is familiar with the concept of food safety, the impact of food quality on human health, and food safety protection measures. The student is familiar with factors that influence food quality. The student has extensive knowledge of legal regulations concerning food safety.

*Skills*: The student relies on various sources of information about food quality and safety. The student independently and comprehensively analyzes problems relating to food and feed safety. The student identifies and evaluates measures which are undertaken to guarantee food safety and proposes solutions for improving food quality. The student proposes effective instruments of voluntary support for food quality.

*Social Skills*: The student assumes responsibility for the quality and safety of food during the entire production process. The student recognizes the need for implementing food safety strategies at all levels of management. The student recognizes the need for expanding his/her knowledge about food safety.

# Business organization and management

*Educational objectives*: Students learn about the theoretical and practical aspects of business management, organization and operation. Students acquire basic knowledge about the range of organizational and management tasks in a business.

*Course Content – Lectures*: Organization and management in theory and practice. The economy as the object of economic science. Enterprise as a unit of economic activity. Division of labor and organizational structure. Principles and models of organizational structure. Managing an enterprise and management in an enterprise. Basic management functions. Risk as the key feature of management. Strategic and operational components of management. Identification and characterization of strategic problems. The significance of small-sized enterprises in selected countries, including in Poland. Differences between variously-sized enterprises. Innovation in a small business. Family business – characteristic features.

*Course Content – Classes*: Presentation of a model business management system – case study. Presentation of business strategies – case study. Analysis of the business environment. Company analysis. Sources of risk in business activity. A company’s goals – map of goal intensity. A company’s organizational structure – identification of resources required for the achievement of goals. Human resource management systems. Motivational systems in an enterprise. Control and monitoring systems in an enterprise. Planning a strategic framework in an enterprise. Indicators for evaluating and organization and its elected components. Innovative processes in an enterprise. The environmental impact of an enterprise. Corporate social responsibility (CSR).

*Learning Outcomes*:

*Knowledge*: The student is familiar with factors that influence the business sector in Poland. The student recognizes the benefits of corporate social responsibility.

*Skills*: The student selects and uses tools that are applied in business management.

*Social Skills*: The student promotes responsible attitudes towards the company and its employees.

# Rural development programming

*Educational objectives*: Students learn about local strategies and programs for stimulating rural development.

*Course Content – Lectures*: Classification and delimitation of rural areas. Rural development concepts (multi-functional development, sustainable development, endogenous sources of rural development). Strategic planning at the local level. Preparation and implementation of development programs and strategies. Project management. Good practices in rural development (clusters, producer groups, cooperatives, thematic villages, local partnerships, etc.). Local Action Groups as a tool for stimulating rural development.

*Course Content – Classes:* Prospects for rural development. Criteria for evaluating rural development. Characterization of rural areas on the example of a Polish region. Evaluation of human resources. Evaluation of the local economy. Quality of rural life. Differences in the rate of rural development – analysis of variations in the rate of development of rural and urban-rural municipalities. The municipal strategy as an instrument promoting local development – analysis of possibilities and limitations on the example of municipalities with various rates of development. Local development strategy as a tool for promoting social and economic initiatives in rural communities. Partnership for rural development. Methods of activating and motivating local communities on the example of cooperatives and thematic villages – study tour.

*Learning Outcomes:*

*Knowledge*: The student is familiar with rural development programming and the principles of designing and implementing development strategies.

*Skills*: The student prepares strategies and programs stimulating rural development. The student manages projects.

*Social Skills:* The student plays an active role in problem-solving groups. The student recognizes the significance of collaborative entrepreneurship in rural development.

**IV. COURSE UNITS RELATED TO THE SPECIALTY AREA**

# Strategic Management and Planning

*Educational objectives*: Presentation of strategic analysis methods that can be deployed in various business scenarios.

*Course Content – Lectures*: The role of strategic planning in management. Strategic management and its components. Definition of strategy, object and scope of strategic management. Strengths, weaknesses and significance of strategic planning. Basic concepts in strategic management. Stages of the strategic management process. Objectives of strategic organization. Mission statement. Vision and identity. Strategic analysis of the business environment. Selected methods of analyzing a company’s market status. Balanced scorecard as a tool for monitoring strategy performance. Strategic planning in small-sized enterprises. The significance and roles of organizational culture in strategic planning. Fusion, take-over, strategic alliance.

*Course Content – Classes*: Presentation of strategic analysis methods. Scenario analysis. Porter’s five forces analysis. Sectoral analysis. Strategic group mapping. Product life cycle analysis. BCG matrix analysis. GE matrix analysis. ADL matrix analysis. SWOT analysis. TOWS analysis. SPACE matrix analysis. Strategic gap analysis. Planning strategic goals. Development of a balanced scorecard.

*Learning Outcomes*:

*Knowledge*: The student identifies and describes various strategic analysis methods. The student identifies barriers to different types of business activity. The student interprets social and economic phenomena.

*Skills*: The student uses strategic analysis and planning methods. The student develops strategies for various types of businesses. The student identifies and explains processes in the company’s internal and external environment.

*Social Skills*: The student accumulates data and shares them with the student community. The student actively shapes the environment.

1. **Agricultural Marketing**

*Educational objectives*: Presentation of marketing strategies applied on the market of agricultural products and services, and instruments supporting the management of agricultural organizations.

*Course Content – Lectures*: Significance of marketing in attaining economic efficiency; the role of marketing strategies in agribusiness management; the farm as a marketing system. Marketing information on the food market and its influence on purchasing decisions; the product as an instrument in food marketing; the role of food packaging; Polish food brands; the main considerations in promotional campaigns; market monitoring methods; marketing expenditures.

*Course Content – Classes*: Food marketing strategy and tactics; the role of the product in marketing; improving management efficiency through distribution; food promotion instruments and price strategies. Components of marketing research.

*Learning Outcomes*

*Knowledge*: The student is familiar with the principles of marketing strategies. The student understands marketing concepts. The student is familiar with the specific features of agricultural marketing.

*Skills*: The student is familiar with specific marketing instruments in farms and agricultural businesses. The student applies management and marketing planning methods in practice. The student develops product or service management strategies in agribusiness.

*Social Skills*: The student recognizes the significance of marketing strategies in business. The student solves marketing problems individually and in a group.

1. **Graduate Seminar in the Specialty Area - I**

*Educational objectives*: Preparation for writing the Master’s thesis and taking the Master’s degree examination. Students learn to solve problems in a scientific and creative manner by identifying and verbalizing scientific problems, formulating research hypotheses, logically and rationally selecting research materials and methods, finding reference materials, performing statistical analysis, rationally presenting and discussing research results.

*Course Content – Classes*: Individual and team work: presentation of selected research topics based on reference materials. Reviewing the literature in the specialty area and preparing for the Master’s degree examination. Research methodology in landscape architecture. Research methodology for the Master’s thesis. Writing the Master’s thesis – chapters and their content. Selection of the research area and the research problem. Presentation of the existing knowledge relating to the selected research problem. Scope of research and methodology. Descriptive and graphic presentation of results. Interpretation of research results based on the available literature. Making inferences and drawing conclusions.

*Learning Outcomes*:

*Knowledge:* The student is familiar with research methodology in agriculture. The student is familiar with methods of statistical analysis and interpretation of research results. The student is familiar with basic research principles and copyright protection laws.

*Skills*: The student solves theoretical and practical problems in agriculture. The student processes and interprets research results. The student compares the results of own research with other authors’ findings.

*Social Skills*: The student is prepared for research and recognizes the need for lifelong learning and skills improvement. The student plans research, inspires others and cooperates with other members of the research team. The student puts theoretical knowledge to practice upon the observance of legal regulations and ethical principles.

# Graduate Seminar in the Specialty Area - II

*Educational objectives*: Preparation for writing the Master’s thesis and taking the Master’s degree examination. Students learn to solve problems in a scientific and creative manner by identifying and verbalizing scientific problems, formulating research hypotheses, logically and rationally selecting research materials and methods, finding reference materials, performing statistical analysis, rationally presenting and discussing research results.

*Course Content – Classes*: Individual and team work: presentation of selected research topics based on reference materials. Reviewing the literature in the specialty area and preparing for the Master’s degree examination. Research methodology in landscape architecture. Research methodology for the Master’s thesis. Writing the Master’s thesis – chapters and their content. Selection of the research area and the research problem. Presentation of the existing knowledge relating to the selected research problem. Scope of research and methodology. Descriptive and graphic presentation of results. Interpretation of research results based on the available literature. Making inferences and drawing conclusions.

*Learning Outcomes:*

*Knowledge*: The student is familiar with research methodology in agriculture. The student is familiar with methods of statistical analysis and interpretation of research results. The student is familiar with basic research principles and copyright protection laws.

*Skills*: The student solves theoretical and practical problems in agriculture. The student processes and interprets research results. The student compares the results of own research with other authors’ findings.

*Social Skills*: The student is prepared for research and recognizes the need for lifelong learning and skills improvement. The student plans research, inspires others and cooperates with other members of the research team. The student puts theoretical knowledge to practice upon the observance of legal regulations and ethical principles.

# Graduate Seminar in the Specialty Area – III

*Educational objectives*: Preparation for writing the Master’s thesis and taking the Master’s degree examination. Students learn to solve problem in a scientific and creative manner by identifying and verbalizing scientific problems, formulating research hypotheses, rationally selecting research materials and methods, finding reference materials, performing statistical analysis, rationally presenting and discussing research results.

*Course Content – Classes*: Individual and team work: presentation of selected research topics based on reference materials. Reviewing the literature in the specialty area and preparing for the Master’s degree examination. Research methodology in landscape architecture. Research methodology for planning the Master’s thesis. Writing the Master’s thesis – chapters and their content. Selection of the research area and the research problem. Presentation of the existing knowledge relating to the selected research problem. Scope of research and methodology. Descriptive and graphic presentation of results. Interpretation of research results based on the available literature. Making inferences and drawing conclusions.

*Learning Outcomes:*

*Knowledge*: The student is familiar with research methodology in agriculture. The student is familiar with methods of statistical analysis and interpretation of research results. The student is familiar with basic research principles and copyright protection rules.

*Skills*: The student solves theoretical and practical problems in agriculture. The student processes and interprets research results. The student compares the results of own research with other authors’ findings.

*Social Skills*: The student is prepared for research and recognizes the need for lifelong learning and skill improvement. The student plans research, inspires others and cooperates with other members of the research team. The student puts theoretical knowledge to professional practice upon the observance of legal regulations and ethical principles.

# Enterprise Management

*Educational objectives:* Presentation of processes in business organization and management.

*Course Content – Lectures*: Organization and management in theory and practice. The economy as the object of economic science. Enterprise as a unit of economic activity. Division of labor and organizational structure. Principles and models of organizational structure. Managing an enterprise and management in an enterprise. Basic management functions. Risk as the key feature of management. Strategic and operational components of management. Identification and characterization of strategic problems. The significance of small-sized enterprises in selected countries, including in Poland. Differences between variously-sized enterprises. Innovation in a small business. Family business – characteristic features.

*Course Content – Classes*: Presentation of a model business management system – case study. Presentation of business strategies – case study. Analysis of the business environment. Company analysis. Sources of risk in business activity. A company’s goals – map of goal intensity. A company’s organizational structure – identification of resources required for the achievement of goals. Human resource management systems. Motivational systems in an enterprise. Control and monitoring systems in an enterprise. Planning a strategic framework in an enterprise. Indicators for evaluating and organization and its elected components. Innovative processes in an enterprise. The environmental impact of an enterprise. Corporate social responsibility (CSR).

*Learning Outcomes*:

*Knowledge:* The student understands the social aspects of company management. The student identifies and describes selected management methods. The student is familiar with support programs for starting and running a business.

*Skills*: The student selects management tools that are most appropriate for the analyzed business. The student identifies business problems and proposes solutions. The student sets directions for business growth.

*Social Skills:* The student proposes solutions to problems individually and in a group. The student identifies social problems that influence entrepreneurship.

# Banking and Finance

*Educational objectives*: Students acquire knowledge in the area of economic theory and accounting. Students learn to apply basic economic concepts in practice and analyze financial statements.

*Course Content – Lectures*: The Polish banking system. The role of money. Monetary policy. Financial markets. Banking operations. Bank management. Financial liquidity. Rate of return and debt. Financial organization. Types and sources of capital. Assets and asset classification. Business performance and financial performance. Development financing. Controlling financial plans.

*Course Content – Classes*: Solving practical problems in finance and banking. Calculating liquidity, rate of return, financial leverage and capital market ratios for different types of businesses. Assets and liabilities in a company. Financial instruments. Calculating NPV and IRR.

*Learning Outcomes:*

*Knowledge:* The student is familiar with the Polish banking system. The student interprets financial indicators. The student evaluates companies’ financial performance.

*Skills:* The student evaluates a company’s performance. The student analyzes a company’s balance sheet and identifies factors that influence its financial performance.

*Social Skills*: The student recognizes the need for lifelong learning. The student works independently and in a group.

# Master’s Thesis - I

*Educational objectives*: Students use the acquired knowledge to solve specific agricultural problems in the Master’s thesis.

*Course Content – Classes*: The subject of a Master’s thesis should be consistent with the academic profile in the field of agriculture. The Master’s thesis should address technical, organizational and economic problems in agriculture.

*Learning Outcomes*:

*Knowledge*: The student observes copyright laws when writing his/her Master’s thesis.

*Skills*: The student relies on various sources of information to discuss a given problem. The student improves his/her competences to the extent required for solving the discussed problem. The student evaluates technical and organizational solutions and proposes own solutions to the problem discussed in the Master’s thesis. The student plans and performs the activities required to solve the problem discussed in the Master’s thesis. The student analyzes and interprets results and draws conclusions. The student prepares a Master’s thesis that is concise and well written.

*Social Skills:* The student has effective communication skills. The student develops a competency improvement plan.

1. **Master’s Thesis - II**

*Educational objectives*: Students use the acquired knowledge to solve specific agricultural problems in the Master’s thesis.

*Course Content – Classes*: The subject of a Master’s thesis should be consistent with the academic profile in the field of agriculture. The Master’s thesis should address technical, organizational and economic problems in agriculture.

*Learning Outcomes*:

*Knowledge*: The student observes copyright laws when writing his/her Master’s thesis.

*Skills*: The student relies on various sources of information to discuss a given problem. The student improves his/her competences to the extent required for solving the discussed problem. The student evaluates technical and organizational solutions and proposes own solutions to the problem discussed in the Master’s thesis. The student plans and performs the activities required to solve the problem discussed in the Master’s thesis. The student analyzes and interprets results and draws conclusions. The student prepares a Master’s thesis that is concise and well written.

*Social Skills*: The student has effective communication skills. The student develops a competency improvement plan.

1. **Graduate Workshop**

*Educational objectives*: Students learn the necessary skills for writing a Master’s thesis.

*Course Content – Classes*: The experimental part of the Master’s thesis.

*Learning Outcomes*:

*Knowledge*: The student is familiar with the methodology applied in the experimental part of the Master’s thesis.

*Skills:* The student has the required practical skills and selects the appropriate research methods for the experiment.

*Social Skills*: The student recognizes the need for continuous improvement of his/her practical research skills.

1. **Human Resource Management**

*Educational objectives:* Students acquire rudimentary knowledge of human resource management. Students learn to apply basic methods and techniques in the process of human resource management.

*Course Content – lectures*: The significance of human resource management and its place among other scientific disciplines. The key tasks in human resource management. The functions of human resource management. Management culture. Human resources – human characteristics. The Japanese model of human resource management. Internal labor market – quantitative harmonization. Motivation, influence, effects, strategies. Identifying the human resource needs of an organization. Employment planning. A microeconomic approach to human resources. Human resource management and development through internal and external recruitment. Career management. Significance of employee assessment in human resource development. Private sector earnings. Mental health promotion. Personal development planning. Self-management and change.

*Course Content – Classes*: Job description and candidate requirements. Writing a CV and a resume. Job interview. Internal and external recruitment – strengths and weaknesses. Employee assessment. Remuneration. Employee training and assessment. Types of remuneration and wage deductions.

*Learning Outcomes*:

*Knowledge*: The student is familiar with the main functions of human resource management. The student is familiar with motivational techniques for employees. The student is familiar with recruitment procedures.

*Skills:* The student recognizes the need for self-education. The student evaluates human resource departments in a company.

*Social Skills:* The student recognizes the need for continuous improvement of core competencies. The student manages human resources in a company.

**V. PRACTICAL TRAINING**

1. **Practical training**

*Educational objectives*: Student learn to plan and organize scientific experiments in agriculture.

*Course Content – Classes*: Methods of planning and organizing small-scale and large-scale field experiments, pot experiments, greenhouse experiments and laboratory experiments in agriculture. Research and scientific methods in agriculture. Stages of the research process (formulation of the research problem, formulation of research hypotheses and theoretical solutions, planning empirical processes, developing the research methodology or the experimental design, collecting evidence, selecting statistical methods, verifying results, collecting and processing data). Observance of copyright laws when planning and organizing research.

*Learning Outcomes:*

*Knowledge:* The student plans empirical processes (in field, pot, greenhouse and laboratory experiments) in agriculture. The student is familiar with the principles of designing research methods (experimental design) in agriculture. The student observes copyright laws when planning experiments.

*Skills:* The student conducts field, pot, greenhouse and laboratory experiments and surveys under supervision. The student observes copyright laws when selecting and gathering data.

*Social Skills:* The student recognizes the importance of planning in scientific research. The student has teamwork skills.

**VI. OTHER REQUIREMENTS**

1. **Rules of etiquette**

*Educational objectives*: Students are introduced to the ceremonial aspect of protocol procedures, rules of etiquette and respect for precedence.

*Course Content – Lectures*: Introduction to rules of etiquette and processes of diplomatic protocol during formal functions. Cultural differences in rules of etiquette and diplomatic protocol. Table manners.

*Learning Outcomes*

*Knowledge:* The student is familiar with the basic principles governing interpersonal relations in private and professional life.

*Skills:* The student abides by rules of etiquette and courteousness in private and professional life.

*Social Skills:* The student recognizes the importance of rules of etiquette in interpersonal relations.

# Occupational health and safety

*Educational objectives*: Students learn procedures for handling accidents and emergencies at university, the causes and circumstances of accidents involving university students, first aid procedures, potential risks to be avoided by university students.

*Course Content – Lectures*: Occupational health and safety regulations (Constitution of the Republic of Poland, Labor Code, Regulation of the Minister of Science and Higher Education of 5 July 2007 on occupational health and safety in universities). Identification and evaluation of life and health hazards in different fields of study (dangerous, harmful and unpleasant factors). Causes and circumstances of accidents involving university students. Procedures for handling accidents and emergencies at university (e.g. fire). First aid procedures and the first aid kit. The training addresses the specific needs of different study fields and identifies the potential threats in those environments.

*Learning Outcomes*:

*Knowledge:* The student is familiar with the procedures for handling accidents and emergencies at university, the causes and circumstances of accidents involving university students and first aid procedures.

*Skills:* The student safely handles dangerous and harmful substances and materials and is familiar with occupational safety requirements. The student uses personal protection equipment and rescue equipment. The student gives first aid.

*Social Skills:* The student exercises caution in handling dangerous and harmful substances and materials. The student observes and promotes the observance of occupational health and safety regulations by others. The student is responsible for occupational health and safety in his/her environment. The student participates in emergency procedures.

1. **Ergonomics**

*Educational objectives:* Students are introduced the interdisciplinary concept of ergonomics, the problems (including health problems) associated with ergonomic deficiencies in and outside the workplace, and the benefits of ergonomic solutions.

*Course Content – Lectures:* Ergonomics – basic concepts and definitions. Ergonomics as an interdisciplinary science. The main trends in ergonomics: workplace ergonomics (physical and mental effort in the workplace, adapting the workstation to specific workers and tasks, the work environment), product ergonomics – ergonomic quality engineering, ergonomics for elderly and disabled persons. Ergonomics of standing and sitting work stations.

*Learning Outcomes*:

*Knowledge*: The student is familiar with the basic concepts in ergonomics, in particular work station ergonomics.

*Skills:* The student identifies ergonomic problems and threats in and outside the workplace.

*Social Skills:* The student adopts an anthropocentric approach to working and living conditions. The student actively responds to threats resulting from ergonomic deficiencies. The student identifies the needs of disabled persons in the realm of ergonomics.

1. **Patent Information**

*Educational objectives:* Students develop an understanding of the legal, normative and practical aspects of patenting and protecting inventions, industrial designs, utility models and know-how. They learn about the basic concepts, principles, goals and key regulations relating to Polish and European copyright laws.

*Course Content – Lectures*: Basic concepts and definitions relating to industrial property, patents, inventions, patent protection, industrial designs, utility models, trademarks, geographical indication, chip topography, protective laws, rights in registration. Copyright law and copyright protection. Related rights. Industrial property and the provisions of the Industrial Property Law. Industrial property protection system. Patents and inventions as objects of patent law. History of patents and patent policy. Subject matter of patents. Content and scope of a patent. Patent registration procedure. International access to patent information. Copyright law in the European Union. Copyright law in the Internet. Copyright transfer agreements. Systems for the protection of utility models and industrial designs.

*Learning Outcomes*

*Knowledge:* The student is familiar with industrial property concepts such as intellectual property, invention, patent, industrial design, utility model, geographical indication, chip topography and know-how. The student is familiar with the patent policy and patent registration procedures in Poland and other countries.

*Skills:* The student identifies various types of industrial property, the applicable protection laws and protection periods.

*Social Skills:* The student recognizes the significance of intellectual property protection. The student is familiar with the risks and penalties relating to illegal appropriation of intellectual property.

1. **Protection of intellectual property**

*Educational objectives*: Students learn the basic principles, concepts and procedures relating to intellectual property protection.

*Course Content – Lectures*: Intellectual property concept. Subject matter of intellectual property. Owners of intellectual property. Intellectual property law – copyrights and related rights. Limitations of intellectual property. Compulsory and contractual licenses. Public copyright license. Copyright infringement (plagiarism and piracy). Detailed regulations of the copyright law – protection of computer programs and databases.

*Learning Outcomes:*

*Knowledge*: The student is familiar with the basic concepts relating to intellectual property protection.

*Skills:* The student identifies and applies limitations and exceptions to copyright in critical analyses and scientific work in the academic environment.

*Social Skills:* The student observes copyright laws in the academic environment and private life (e.g. copyrighted work on the Internet).

**VII. ELECTIVES RELATED TO THE FIELD OF STUDY**

1. **First and second generation biofuels**

*Educational objectives:*Students acquire knowledge about renewable hydrocarbon biofuels, production technologies and their application. Types of biofuels and production technologies. Sustainable production and use of biofuels in the European Union and the world.

*Course Content – Lectures:*Definition of first-generation and second-generation biofuels. Production technologies of first-generation and second-generation as alternatives for petroleum-based fuels. Benefits associated with the use of plant-based biofuels in agriculture and the national economy. Biological and thermal methods of biofuel conversion. Types and applications of fuel cells. Profitability and risk analyses of innovative technologies for the production and application of liquid biofuels.

*Course Content – Classes:*Biomass conversion technology. Production of first-generation biofuels from food crops. Production of second-generation biofuels from non-food crops. Production technology of first-generation and second-generation biofuels. Biofuels as an alternative to petroleum-derived fuels. Biomass and biofuel production chains. Organisms used in biofuel production. The basic principles of fuel cells. First-generation and second-generation biofuels in sustainable development.

*Learning Outcomes:*

*Knowledge:* The student has extensive knowledge of biofuel production from food and non-food crops grown in rural areas.

*Skills:* The student applies theoretical knowledge to propose suitable technologies for processing agricultural products into biofuel.

*Social Skills:* The student is familiar with the consequences and environmental impacts of human activities.

1. **Progress in Dairy Production**

*Educational objectives:* Students learn about the milk and dairy product market. Students acquire theoretical and practical knowledge about the quality of raw milk, its determinants, processing technology, production principles and evaluation methods. Students learn about production processes, selected process devices and production lines, production methods and analytical techniques. The student develops skills and attitudes required for self-education and team work.

*Course Content – Lectures:*Dairy raw materials in the EU and Poland. Purchase of and trade in dairy raw materials. The quality, chemical composition and physicochemical properties of raw milk – genetic, physiological and environmental factors, milking and milk handling. The influence of production processes on the composition and properties of milk. Production and consumption of dairy products. Production of non-fermented and fermented milks, concentrates and desserts, butter, ripened cheese and cottage cheese. Biologically active compounds.

*Course Content – Classes:*Evaluation of the quality, composition and physicochemical properties of raw milk. Production technology and physicochemical evaluation of dairy products.

*Learning Outcomes:*

*Knowledge:* The student is familiar with dairy raw materials and the dairy market. The student describes the physicochemical properties of milk and factors that determine the safety and quality of dairy raw materials and dairy products. The student is familiar with production methods in the dairy industry.

*Skills:* The student conducts objective analyses of the dairy industry. The student proposes technological processes for manufacturing basic dairy products and selects analytical methods for performing physicochemical evaluations of milk and dairy products and assessing the effectiveness of production processes.

*Social Skills:* The student recognizes the importance of professional self-development. The student has an active and creative approach to work organization in production, research and reporting.

1. **Crop Rotation Consultancy**

*Course Content – Lectures:*Sudents are introduced to crop rotation, its goals and roles. Crop rotation in recent and ancient history, agricultural systems in history. Environmental, organizational and economic factors in designing crop rotation schemes. Crop rotation in contemporary agriculture. Plant sensitivity to crop rotation and monoculture. Principles of designing crop rotation schemes in various plant and animal production systems. Different methods and criteria for evaluating crop rotation schemes.

*Course Content – Classes:*Basic principles of designing crop rotation schemes. Plant succession and crop rotation in family farms and possible improvements. The influence of soil properties and preceding crops on yield. Designing crop rotation schemes for various habitats, plant and animal production systems. Designing crop rotation models, organic matter and nutrient balances for various crop production systems. Evaluating the influence of crop rotation and monoculture systems on the prevalence of weeds, crop diseases and pathogens and proposing effective remedy solutions. Planning crop rotation schemes in various cropping systems. Natural and organic fertilization, cultivation and pesticide use in various agricultural production systems. Evaluating crop rotation systems.

1. **Agricultural Waste Management**

*Educational objectives:* Students learn about various methods of managing organic and mineral waste in agricultural production.

*Course Content – Lectures:* Legal aspects of waste management. Waste classification. Use of municipal waste and sewage sludge in agriculture and land reclamation. Production and application of composted municipal waste and sewage sludge. Utilization of wastes from food processing, agriculture, energy generation and construction. Threats associated with waste management in agriculture.

*Course Content – Classes:* The composition of municipal waste. Determination of the chemical properties of composed municipal waste. The chemical properties of raw and composted sewage and sewage sludge. Solid industrial waste.

*Learning Outcomes:*

*Knowledge:* The student is familiar with legal regulations relating to the management of waste in agriculture. The student is familiar with the environmental aspects of waste management in agricultural production. The student understands the influence of waste on soil properties and the quality of agricultural produce.

*Skills:* The student identifies the requirements for the use of organic and mineral waste in agriculture. The student is familiar with the environmental risks associated with the use of waste in agriculture.

*Social Skills:* The student is familiar with the environmental risks associated with the use of industrial and municipal waste in soil improvement.

1. **Evaluation of Agricultural Production Area**

*Educational objectives:*Students are familiarized with the method for assessing agricultural production areas in Poland and the European Union, the goals and principles of agricultural zoning in Poland.

*Course Content – Lectures:*Definition and division of agricultural production area. Evaluation criteria and types of agricultural production area. Area and structure of agricultural land by land use type (arable land, meadows, orchards, water bodies, forests) in Poland, the neighboring countries and the EU. The structure of the Polish agricultural sector. Geographic and ecological definitions of landscape. The agricultural landscape and its components. Agricultural characteristics of habitat components in Poland. Criteria for evaluating soil, climate, topography and water resources. Quality of Polish soils (soil quality class and soil suitability classification). Agricultural regions. Impact of climate on agriculture. The effect of topography on agriculture. Geomorphological and agricultural regions in Poland. Water resources in Poland. Water resources for agriculture. Water relations in Polish agriculture. Habitat types in Poland. Agricultural production zones. Management of fallow land and marginal land.

*Course Content – Classes***:** Physical and geographical features of Poland. Decimal system for the classification of physical and geographic features (according to Kondracki). Types of regions, provinces, sub-provinces and their characteristic features. Goals and principles of agricultural assessment. Assessment of agricultural production areas in Poland. Assessment of agricultural production areas based on units of administration. Zoning criteria. Structure of agricultural production areas and agricultural systems. Areas with low suitability for agricultural production.

*Learning Outcomes:*

*Knowledge:* The student is familiar with the main components of the agricultural landscape and the principles for assessing agricultural production areas. The student is familiar with the main agricultural systems and natural conditions in various regions of Poland. The student has the knowledge of natural resources for planning biomass production for food and feed industries.

*Skills:* The student searches for, understands, analyzes and uses information about the quality of agricultural production areas. The student evaluates the influence of natural factors on crop yields.

*Social Skills:* The student uses the acquired knowledge to make decisions relating to agricultural production, management of agricultural production areas and landscape design. The student recognizes the significance of social, professional and ethical responsibility in the process of producing safe and high-quality food and feed, management of agricultural production areas and landscape design.

1. **Water Resource Management in Agriculture**

*Educational objectives:* Students learn about water resource management in Poland, the role of water in the agricultural landscape, methods of regulating water use in agriculture to improve water-air-soil relations and management of agricultural production areas. Students are trained to apply theoretical knowledge to practice in a rural environment. Students learn about technical infrastructure in rural areas. Students develop the awareness that sustainable development of rural areas requires local measures aiming to improve the quality and availability of water resources.

*Course Content – Lectures:*Systemic solutions for water management. Objectives of water management policy in rural areas. Basic methods of evaluating water resources, balance models. Water management problems in agriculture. Water in plants. Availability of soil water for plants. Water requirements of plants. Water requirements of fish ponds. Management of water resources – expanding water resources, preventing water deficits. Water infrastructure in rural areas. Water retention in agricultural catchments, water retention systems, water retention in agricultural areas. Types of water reservoirs, their environmental impacts, management of retention reservoirs. Agricultural treatments for improving soil productivity. Devices and systems for storing and distributing water. Water in soil, soil retention capacity. Methods of preventing drought, water deficit and floods. Counteracting floods, flood losses in Poland. Main sources of water pollution. Degradation and protection of water resources. Self-purification of natural water systems. Methods of improving the quality of underground water.

*Course Content – Classes:*Identifying the demand for water regulation systems in rural areas. Designing retention reservoirs based on the local infrastructure (rivers, canals, drainage ditches, drainage networks). Principles of designing water retention reservoirs in rural areas. Designing water retention reservoirs supplied by natural watercourses and drainage systems. Principles of designing fish ponds. Designing water reservoirs for purifying sewage from small-scale rural wastewater treatment plants, including household treatment plants. Planning soil improvement measures to enhance water and air penetration in soli and prevent soil erosion.

*Learning Outcomes:*

*Knowledge:* The student is familiar with the basic methods, techniques and tools for regulating water relations in agriculture. The student understands the importance of water regulation for environmental management and biodiversity. The student understands the correlation between soil-water-air relations and water requirements in agriculture.

*Skills:* The student relies on various sources of information in analyses of water resources in rural areas. The student works with maps and designs simple water management systems to scale. The student describes the condition and operation of water management systems in specific environments.

*Social Skills:* The student recognizes the importance of lifelong learning in environmental science. The student is familiar with the risks associated with water management in rural areas. The student adopts an enterprising approach to water management in rural areas.