AGRICULTURAL CHEMISTRY

Department of agrochemistry and quality of plant products

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Nadiia P. Bordyuzha**
Term	
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**45 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

During studding of the Agrochemistry students provide the theoretical knowledge and practical skills about the fertilizers application in crop rotation and study the principles of management by soil fertility and plant quality depending on the specific conditions in the crop region growing. Students take the knowledge about the chemical composition of plants, characteristics of their nutrition and ways of its regulation; the soil properties connected with plant nutrition and fertilizers application; the methods of soil chemical melioration; the types of mineral and organic fertilizers; the system of fertilizers application.

Lectures:

1. Agricultural chemistry, its objectives and main tasks. Chemical composition of plants, plant nutrition and methods of its regulation.
2. Agrochemical, agrophysical and biological properties of soil in connection with plant nutrition and fertilization. Soil chemical melioration (liming and gypsum application).
3. Fertilizers, their properties and classification.
4. Nitrogen fertilizers.
5. Phosphate fertilizers and Potassium fertilizers.
6. Micronutrient and multinutrient fertilizers.
7. Organic and bacterial fertilizers.
8. Drones in agronomy.

Classes:

(practical, laboratory classes)

1. Plant analysis. The principles of plants sampling and handling. Determination of necessity of fertilizers application using analysis data. Diagnosis of plant nutrition and fertilizers requirements.
2. The soil analysis. The principles of soil sampling and handling. The determination of nitrates in soil by ionselective method.
3. The determination of mobile phosphorus and exchangeable potassium by Chyrikov method.
4. Determination of neutralizing ability of limestone materials. The calculation of the rate of lime materials application.
5. Qualitative analysis of the macrofertilizers.
6. Fertilizers distribution in crop rotation and determination of the farm saturation by organic and mineral fertilizers.
7. Balance-sheet method of fertilizers rate determination.

AGRICULTURAL ENTOMOLOGY

Department of Entomology, Integrated Pest Management and Quarantine

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Assoc. prof. Tatyana Stefanovska**
Term	
Major	**Bachelor degree**
ECTS credits	**8**
Control	**Exam**
Class-room hours	**240 hours (of them: lectures – 60 hours, practical or laboratory classes – 60 hours)**

Subject overview

In the system of training for the Plant protection quarantine specialists, the course "Agricultural Entomology" is of the great practical importance. This is 1-year undergraduate course that deals with the study of agriculture and its applications in various domains. This course serves as an mandatory course for undergraduate program is a required course for the Plant Protection and Quarantine Major.

Objective of the discipline "Agricultural Entomology": formation of professional knowledge and skills of higher education students to identify pests by morphological characteristics, types of plant damage, justification of the feasibility of taking measures to protect individual crops, taking into account the phytosanitary condition of crops, peculiarities of biology and phenology of harmful phytophages.

The course introduces students to the fundamental concepts of agricultural entomology and pest management including: economic thresholds, sampling techniques, plant resistance to insects, biological control, insecticide use and its consequences and the use of genetically modified plants. The broad course outline is as follows:

- Basics on the status of insect species within the Animal Kingdom and their role in the environment and agriculture in particular, the organization, form and diversity of species of the entomological fauna.
- Basic morphology, anatomy, physiology and systematic classification of key agricultural pests
- The symptoms of insect attack induced on crop plants, stored agricultural products, food and / or livestock.
- Management skills for insect pest species and beneficial species in relation to agriculture and the environment in general.
- Laboratory entomology techniques (processing of fresh samples of infested plants [study of symptoms, stereoscopy, microscope], diagnostic procedure).

Lectures:

1. Introduction to Agricultural entomology.
2. Control of polyphagous pests from order Lepidoptera.
3. Control of polyphagous pests from orders Orthoptera and Coleoptera.
4. Pests of wheat, rye, barley, oat control.
5. Pests of maize, sorghum, rice, buckwheat, millet, grasses control.
6. Pests of annual legumes control.
7. Pests of annual legume control.
8. Pest of soybeans' control.
9. Pests of sunflowers' control.
10. Pests of potato control.
11. Pests of stored products' control.
12. Pests of flax and hemp control.
13. Pests of sunflowers' control.
14. Pests of and oilseed rape control.
15. Pests of hop and tobacco control.
16. Pests of sugar beets' control.
17. Pests of potato control.
18. Pests of tomato management.
19. Management of cabbage and other braincases pests.
20. Management of cucurbits' pests.
21. Pests of carrot control.
22. Pests of onion and garlic control.
23. Management of vegetables in green houses pest.
24. Pests of orchards with piercing sucking moth parts control.
25. Pests of orchards with piercing sucking moth parts control.
26. Management of pests in orchard that damage reproductive organs.
27. Control of orchard pests that damage tree branches and stems.
28. Management of small berries.
29. Control of pests of grapes.
30. Concept of Integrated pest management.

Classes:

(practical, laboratory classes)

1. Polyphagous Orthopteran pests.
2. Polyphagous Lepidoptera pests.
3. Polyphagous Coleoptera pests.
4. Pests of cereal crops of first vegetation.
5. Pests of cereal crops of second vegetation.
6. Pests of corn.
7. Pests of rice, sorghum and millet.
8. Pests of stored grain and its products (Coleoptera).
9. Pests of stored grain and its products (Lepidoptera).
10. Annual legumes' pests.
11. Perennial legumes' pests.

12. Pests of sunflowers.
13. Pests of flax and hemp.
14. Pests of tobacco.
15. Pests of rape.
16. Potato and other Solanacea crops' pests.
17. Tomato pests.
18. Pests of vegetables from family Brassica.
19. Pests of vegetables from family Curcubitaceae.
20. Pests of carrots.
21. Onion and garlic diseases.
22. Pests of vegetable crops in green house.
23. Orchard pests that damage foliage by piercing- sucking moth parts.
24. Orchard pests that damage foliage by chewing moth parts.
25. Orchard pest that damage reproductive organs.
26. Orchard pests of branches and trunks.
27. Raspberry, strawberry and gooseberry pests.

AGRICULTURAL PLANT PATHOLOGY

V.F. Peresypkin Department of Phytopathology

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	**Havryliuk L., PhD in Biological Sciences**
Term/Semester	**4/7,8**
Major	**Bachelor**
ECTS credits	**8**
Control	**Exam**
Class-room hours	**60 hours (30 h Lectures, 30 h Laboratory classes)**

Subject overview

The purpose of the discipline "Agricultural Plant Pathology" is to study diseases of agricultural crops, the species composition of pathogens and areas of their harmfulness, diagnostic signs of the manifestation of diseases on various plant organs, the influence of biotic and abiotic factors of the environment on the development of pathologies, sources and places of reservation of infection, measures to protect against certain diseases and systems of measures against diseases of a specific culture.

Task: studying the spread, symptoms, and harmfulness of diseases of the following groups of crops: grain cereals, grain legumes, annual and perennial leguminous grasses, sorghum, oilseeds, root crops, tubers, vegetables, fruits, berries, and grapes;

Study of the species composition of pathogens of various agricultural crops, their morphological and biological features;

Study of the influence of biotic and abiotic environmental factors on the development of plant diseases;

Clarification of sources and places of reservation of infectious material of pathogens;

Development and substantiation of preventive and therapeutic measures at a high professional level.

As a result of studying the academic discipline, the student should

to know: tasks, goals and objects of agricultural phytopathology; diagnostic signs of diseases on agricultural crops; morphological, biological and ecological features of pathogens; places of reservation and storage of infection; areas of spread of diseases and the extent of crop losses of agricultural plants; substantiation of protective measures against diseases on each agricultural crop;

to be able to: independently determine the most common and harmful diseases of various etiologies on agricultural crops by diagnostic signs; to identify the causative agents of diseases by morphological signs: to predict the development of diseases depending on weather conditions; plan and carry out agrotechnical, seed selection, chemical and biological plant protection measures; justify the expediency of using chemical and biological means of plant protection

against diseases depending on the phytosanitary state of crops; to select and introduce regional disease-resistant varieties and hybrids of agricultural crops for the conditions of a specific farm.

Lectures:

1. Wheat protection system against diseases.
2. Barley protection system against diseases.
3. Corn protection system against diseases.
4. Buckwheat diseases and the system of measures to control them.
5. Diseases of sorghum, sudanka and cereal grasses. System of their control measures.
6. Pea diseases and the system of measures to control them.
7. Soybean diseases and the system of measures to control them.
8. Diseases of beans, fodder beans, lupine and vetch. System of their control measures.
9. Diseases of perennial legumes.
10. Sunflower diseases and the system of measures to control their development.
11. Hemp diseases and measures to limit their development.
12. Flax diseases and measures to limit their development.
13. Diseases of castor beans and measures to limit their development.
14. Rapeseed diseases and measures to limit their development.
15. Tobacco and shaggy diseases. A system of measures to limit their development.
16. Hop diseases and measures to limit their development.
17. Beet diseases and measures to limit their development.
18. Potato diseases and the system of their control measures.
19. Diseases of tomatoes and the system of their control measures.
20. Diseases of cabbage vegetable crops and the system of measures for their control.
21. Onion and garlic diseases and the system of measures to control them.
22. Carrot diseases and the system of their control measures.
23. Diseases of pumpkin crops and the system of measures to control them.
24. Diseases of greens and the system of measures to control them.
25. Diseases of seed fruit crops and the system of measures for their control.
26. Diseases of stone fruit crops and the system of their control measures.
27. Strawberry diseases and the system of measures to control them.
28. Currant and Gooseberry diseases and the system of measures for their control.
29. Raspberry and blueberry diseases and the system of their control measures.
30. Diseases of grapes and the system of their control measures.
31. Diseases of nuts and the system of their control measures.

Classes:

(practical, laboratory classes)

1. Powdery mildew diseases of wheat.
2. Rusty diseases and root rot of wheat.
3. Other diseases of wheat.
4. Diseases of barley.
5. Rye and oat diseases.
6. Diseases of soybeans.
7. Diseases of peas.
8. Diseases of clover and alfalfa.
9. Sunflower diseases.
10. Flax diseases.
11. Rapeseed diseases.
12. Tobacco and pure tobacco diseases.
13. Diseases of hops.
14. Diseases of sugar beets.
15. Diseases of sugar beet roots.
16. Potato diseases.
17. Diseases of tomatoes.
18. Diseases of cabbage.
19. Diseases of onions and garlic.
20. Carrot diseases.
21. Cucumber diseases.
22. Diseases of green vegetables.
23. Diseases of seed fruit crops.
24. Diseases of stone fruit crops.
25. Strawberry diseases.
26. Currant diseases.
27. Raspberry diseases.
28. Blueberry diseases.
29. Diseases of grapes.
30. Diseases of walnut and hazelnut.

AGROZOOLOGY

Department of Entomology, integrated protection and quarantine of plants

Faculty of Plant protection, Biotechnology and Ecology

Lecturer	**Liudmyla Kava**
Term	**1**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, laboratory classes – 45 hours)**

Subject overview

Agrozoology is the scientific study of animals, including their structure, function, embryology, genetics, evolution, classification, and behavior. This course will provide a broad overview of the animal kingdom, with an emphasis on the diversity of animal life and the major principles of animal biology. Topics covered will include:

- The history of zoology
- The diversity of animal life
- The anatomy and physiology of animals
- Animal development
- Animal evolution
- Animal behavior
- Animal ecology

Upon completion of this course, students *will be able to:*

- Understand the basic concepts of zoology
- Identify and classify major groups of animals
- Describe the anatomy and physiology of animals
- Explain the principles of animal development
- Discuss the principles of animal genetics
- Understand the process of animal evolution
- Describe the major types of animal behavior
- Explain the principles of animal ecology
- Discuss the importance of conservation biology.

Lectures:

1. Introduction Understanding the Significance of Optional Subjects with a Focus on Agrozoology.
2. Protozoa. Phyla Sacromastigophora.
3. Phyla Apicomplexa.
4. Phylum Coelenterata.

5. Phylum Nematoda.
6. Phylum Annelida.
7. Phylum Arthropoda.
8. Phylum Mollusca.
9. Phylum Echinodermata.
10. Phylum Protochordata.
11. Phylum Vertebrata. Class Pisces.
12. Phylum Vertebrata. Class Amphibia.
13. Phylum Vertebrata. Class Reptilia.
14. Phylum Vertebrata. Class Aves.
15. Phylum Vertebrata. Class Mammalia.

Practical Classes:

1. Classification and general features and life history: Acoelomate, Protostomes, Bilateria; Protista, Parazoa, Onychophora, Hemichordata (2 hours)

2. Protozoa: locomotion, nutrition, reproduction, sex; general features and life history of Paramaecium, Monocystis, Plasmodium and Leishmania. (2 hours)

3. Porifera: skeleton, canal system and reproduction (2 hours) .

4. Cnidaria: polymorphism, defensive structures and their mechanism; coral reefs and their formation; metagenesis(2 hours) .

5. Platyhelminthes: parasitic adaptation; general features and life history of Fasciola and Taenia and their pathogenic symptoms (2 hours).

6. Nemathelminthes: general features, life history, parasitic adaptation of Ascaris and Wuchereria (2 hours) .

7. Annelida: coelom and metamerism; modes of life in polychaetes; general features and life history of Nereis, earthworm and leech (2 hours).

8. Arthropoda: larval forms and parasitism in Crustacea; vision and respiration in arthropods (Prawn, cockroach and scorpion); modification of mouth parts in insects (cockroach, mosquito, housefly, honey bee and butterfly); metamorphosis in insect and its hormonal regulation, social behaviour of Apis and termites (4 hours) .

9. Mollusca: feeding, respiration, locomotion, general features and life history of Lamellidens, Pila and Sepia, torsion and detorsion in gastropods (2 hours).

10. Echinodermata: feeding, respiration, locomotion, larval forms, general features and life history of Asterias (2 hours).

11. Protochordata: origin of chordates; general features and life history of Branchiostoma and Herdmania (2 hours) .

12. Pisces: respiration, locomotion and migration (4 hours).

13. Amphibia: general features, origin of tetrapods, parental care, paedomorphosis (4 hours).

14. Reptilia: origin of reptiles, skull types, status of Sphenodon and crocodiles.

15. Aves: general features life history, light adaptation and migration (4 hours).

16. Mammalia: general featuresdentition, general features of egg laying mammals, pouched-mammals, aquatic mammals and primates, endocrine glands (pituitary, thyroid, parathyroid, adrenal, pancreas, gonads) and their interrelationships. (4 hours).

BASICS OF BIOTECHNOLOGY IN PLANT PROTECTION

Department of Ecobiotechnology and Biodiversity

Faculty of plant protection, biotechnology and ecology

Lecturer	**Kolomiiets Yu.V.**
Term	**Bachelor or Master degree**
Major	**Protection and quarantine of plants**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**45 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

Biotechnology – is a field of modern science and technology, the main task of which is the use of biological processes, systems and organisms in various fields of human activity, first of all in agriculture. The issues of improving the existing and creating new highly productive, resistant to biotic and abiotic factors, plant varieties, beneficial strains of microorganisms are of paramount importance. An important role in addressing of these issues is played by biotechnological methods that contribute to the transformation of agriculture into a highly efficient, competitive, environmentally friendly industry.

Plant biotechnology uses advances in molecular biology, genetic engineering, tissue, cell and protoplast cultures, aimed at creating high-yielding varieties, constructing recombinant DNA, increasing the genetic diversity of plants, overcoming barriers to interspecific crossing.

Cloned DNA can be successfully used for virus identification and qualified culling of affected material. With the help of plant tissue culture in a relatively short time and in a limited space, you can have many populations, including mutants suitable for breeding purposes. In tissue culture, lines with increased photosynthesis intensity and higher productivity can be identified. The method of microclonal propagation makes it possible to obtain genetically homogeneous planting material, to grow healthy plants free from viral infections. Mastering the theoretical basis and practical skills of working with in vitro plant culture, obtaining transgenic plants and plants resistant to herbicides, diseases and pests by genetic engineering is a necessary condition for the formation of highly qualified agricultural specialists.

Lectures:

1. Modern methods of biotechnology. The history of the development of biotechnology.
2. Plant tissue and cell culture in vitro as the main method of plant biotechnology.
3. Microclonal propagation and healing of plants using meristem culture.
4. Methods of obtaining plant protoplasts. Methods of obtaining somatic hybrids using the fusion of protoplasts.
5. Haploidy. Androgenesis. Gynogenesis. Embryo culture. The main approaches to obtaining remote hybrids using in vitro culture methods.
6. Variability of the genome of somatic cells in vitro. Causes, mechanisms and consequences of mutagenesis in vitro. Cell selection.
7. Genetic engineering is a new direction of biotechnology. Construction and cloning of recombinant DNA. Safety problems of the use of biotechnology in plant protection.

Classes:

(practical, laboratory classes)

1. Biotechnology laboratory: structure and equipment.
2. Preparation of nutrient media for culturing isolated plant cells and tissues.
3. Sterilization of soybean seeds to obtain sterile seedlings.
4. Sterilization of carrot roots and potato tubers and their introduction into *in vitro* culture.
5. Obtaining callus tissue from tobacco leaves.
6. Induction of organogenesis in callus tissue of potatoes.
7. Obtaining a suspension culture of callus tissue.
8. Isolation and cultivation of protoplasts.
9. Obtaining virus-free planting material with thermotherapy method in combination with cultivation of apical meristems.
10. Micropropagation of cloves (potatoes) by cuttings.
11. Record of growth characteristics of plant regenerants.
12. Induction of rooting in microclonal reproduction of gerberas.
13. The effect of auxins, cytokinins and gibberellins on the growth and development of micro cuttings of stevia, potatoes, cloves.
14. Preparation of nutrient medium for cultivation of *Agrobacterium tumefaciens.*
15. Transformation of tomato plant cells under the effect of *Agrobacterium tumefaciens.*

BIOLOGICAL CONTROL

Department of Entomology, Integrated Pest Management and Quarantine

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Assoc. prof. Tatyana Stefanovska**
Term	
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours)**

Subject overview

The overall course objective is to familiarize students with the principles and practices of using natural enemies and antagonists to manage the abundance of, and damage caused by, pests (invertebrates, plant pathogens, and weeds) in field crops, vegetable crops, fruit and berry plantations Primary focus will be placed on the biological control of pests of different plant systems . The discipline is aimed at familiarizing students with the basics of systematics, biology and ecology of the main groups of biological agents: entomophages, herbivores, pathogens and antagonists of the most important pests, weeds and pathogens of agricultural crops. After course accomplishment students will be able to do:

- Describe some of the more typical natural enemies that can be used to control invertebrate pests, plant pathogens, and weeds, as well as the relative benefits and drawbacks of doing so.
- Describe how biological control is affected by ecological, physiological, and biochemical processes.
- Describe the many methods used to control pests via natural enemies and how each method fits into the integrated pest management framework.
- Describe the advantages and disadvantages of utilizing various biological control methods.
- List the monetary and legal elements that influence the creation and marketing of biological controls.
- Create a program outline for biological control for certain production systems.
- Describe the advantages and disadvantages of utilizing various biological control methods.
- List the monetary and legal elements that influence the creation and marketing of biological controls.
- Create a program outline for biological control for certain production system.

Lectures:

1. State of the art on current biocontrol use and perspectives in Ukraine.
2. History of biological control.
3. Type of relations between organisms In biocenoses, which are most important for biological control.
4. Principal strategies in biological control.
5. Review of main entomophages and acaripfages in open and protected field.
6. Use of Trichogramma to control Lepidoptera pests.
7. Classical biological control.
8. Characteristic of fungal diseases of insect.
9. Characteristic of fungal pathogens of insect pests.
10. Characteristic of bacterial pathogens of insect pest.
11. Characteristic of antagonistic fungi and its use to control plant pathogens.
12. Entomopathogenic nematodes for control of insect pests.
13. Mode of action and term if use of biopesticides produced based on entomopathigenic viruses and entomopathogenic fungi.
14. Review of biopesticides produced on basis of entomopathogenic bacteria and nematodes.

Classes:

(practical, laboratory classes)

1. Review of key orders where entomophagous belong to.
2. Biology, life cucle and of reproduction of bioagents: insects, mites, nematodes.
3. Entomophages of polyphagous pests.
4. Entomophages of cereal and grain crops' pests.
5. Entomophages of legumes.
6. Entomophages of technical crops.
7. Entomophages of vegetable crops in the open field.
8. Entomophages of vegetable and ornamental crops in green house.
9. Entomophages of orchards and berries plantations.
10. Identification on four key Trichogramma species in Ukraine that are used in biocontrol programs.
11. Mode of action and guidelines for using of microbial pesticides that are based on entomnopathogenic viruses for biocontrol.
12. Mode of action and guidelines for using of microbial pesticides that are based on entomnopathogenic bacteria for biocontrol.
13. Mode of action and guidelines for using microbial pesticides that are based on entomopathogenic and antagonists to disease pathogenic fungi in biocontrol.
14. Microbial pesticides that are based on entomopathogenic and antagonists to disease fungi in biocontrol.
15. Mode of action and guileless of usage for bio stimulants

BOTANY

Department of Botany, Dendrology and Forest Tree Breeding

Faculty of Forestry and Landscape-Park Management

Specialty 202 Plant protection and quarantine

Lecturer	**Associate Professor, PhD in Biological Sciences Anatoliy Tertyshnyi**
Term	**1**
Major	**Bachelor or Master degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

Purpose is to study the laws of development of plants as major components of biosphere.

objectives are

- to study botanical terminology and methods of investigation of plants that are necessary to study plants on practice; to form for student's general vision of the plant world.
- to learn, to analyze and to work with the literature and botanical objects;
- to learn a technique of experimental research of botanical objects in laboratory and in practice;
- to learn the laws of morphological and anatomical structure and development of plants and microorganisms;
- to learn a technique of identification of plants, their taxonomy;
- to learn and to analyze the botanical phenomena, changes and to form the appropriate conclusions.

As a result of teaching of academic subject the student

has to know terms, systematic and main groups of plants;

can operate on the botanical terminology and methods of investigation of plants that are necessary to study plants on practice. The variety of plants induces the study of specific features of different groups of plants, their development, phylogenic relations and value for agriculture.

Acquisition of competencies: :

Integrated competency (IC):

Ability to solve complex specialized problems and practical problems of professional activity with protection and quarantine of plants and apply theoretical knowledge and methods of phytosanitary monitoring, review, analysis, expertise, which are characterized complexity and uncertainty of conditions.

General competencies (GC):

GC 2. Ability to apply knowledge in practical situations

GC 3. Knowledge and understanding of the subject area and understanding of professional activity.

Professional (special) competencies (PC): –

Program learning outcomes (PLO):

PLO 4. Have knowledge of the fundamental sections of higher mathematics, biophysics, chemistry (analytical, organic, inorganic, physical and colloid), botany and agrozoology to the extent necessary for understanding the processes of the specialty protection and plant quarantine.

Lectures:

1. Introduction to Botany.
2. Plant cell.
3. Plant tissues.
4. Vegetative organs of plants.
5. Propagation of plants.
6. Genarative organs of angiosperm plants.
7. Introduction to plant systematic. LUCA, Bacteria, Arkarya. Amorphea: Fungi. Archaeplastida: Glaucophyta, Rhodophyta, Viridiplantae.
8. Marschantiophyta, Bryophyta, Anthocerotophyta, Lycophyta Euphyllophyta, Monilophyta, Spermatophyta: Gymnospermatophyta. Structure, life cycles, biology.
9. Angiosperm plants. (Magnoliophyta, APG IV): ANA GRADE, MAGNOLIIDS, MONOCOTS, EUDICOTS, SUPERROSIDS.
10. SUPERASTERIDS, ASTERIDS
11. Phytogeography. Flora. Areals of plants. Main ecological factors and its influence on plants.
12. Phytocoenology. Vegetation. Types of vegetation. Systematic of phytocenosises.

Classes:

(practical, laboratory classes)

1. Structure of microscope. Scills at using of microscope. Structure of plant cell. Plastids. Storage materials. Starch and aleirone grains.
2. Dermal tissues. Primary dermal tissue. Secondary and tertiary dermal tissues.
3. Morphological structure of the root and its modifications. Regions of the root, primary anatomical structure, morphological and anatomical regions of the root. Anatomical structure of the root. Peculiarities of the anatomical structure of root crops.
4. Morphological structure of the shoot. Anatomical structure of the stem of monocot. Anatomical structure of the herbal dicot plants. Bundle type of

structure. Anatomical structure of spinning plants stem. Macroscopic structure of the woody stem. Anatomical structure of the leafy plant stem.

5. Anatomical structure of the maize leaf and *Camellia japonica*. Pecularities of the structure of the *Pinus sylvesris* needle.

6. Fungi. Chytridomycota, Chytridiomyocetes. Oomycota, Oomycetes. Zygomycota. Ascomycota, Ascomycetes. Basidiomycota, Basidiomycetes. Lichens.

7. Algae. Chlorophyta, Charophyta, Charophyceae.

8. Marchantiopsida, Bryopsida. Structure of vegetative and reproductive organs of Lycopodium clavatum, *Selaginella selaginoides*. Morphological structure of *Equisetum arvense*. Strobile and spore structure. Polypodiophyta. Structure of sporophyte and gametophyte of *Dryopteris filix-mas.*

9. Pinophyta. Pinopsida.

10. Flower morphology. Formula and diagram of flower. Types of inflorescences.

11. Anatomy of flower. Structure of stamen, ovary and seed embryo. Seed formation. Seed structure of monocots and dicots plants.

12. Fruit formation. Structure and classification of fruits. Collective fruit.

13. Methodology of herbarization. Plan of morphological analysis. Plant identifying. Plant identifying of Ranunculaceae species.

14. Plant identifying of Boraginaceae, Rosaceae, Brassicaceae, Fabaceae.

15. Notion of phytocenosis and its structure. Elements of Agrophytocenology Plant identifying of Liliaceae, Poaceae, Cyperaceae species.

CHEMISTRY: PHYSICAL AND COLLOIDAL

Department of General, Organic and Physical chemistry

Faculty of Protection of plants, Biotechnology and Ecology

Lecturer	**Boiko Roman**
Term	**3**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**45 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

The development of the agro-industrial complex requires the training of specialists with knowledge of basic sciences and able to use all the possibilities of modern science to solve current problems, introduce advanced technologies to protect plants from pests and the negative impact of the environment. The course of physical and colloid chemistry aims to give a clear idea of the theoretical and experimental foundations of science, defining its special role as an interdisciplinary science that synthesizes knowledge of related fields of chemistry, physics, biology and other natural sciences. Physical chemistry studies the relationship between physical phenomena that accompany chemical transformations and, making extensive use of theoretical and experimental methods of physics and chemistry, generalizes the actual material of different sections of chemistry, reveals the general laws of chemical reactions. Colloid chemistry studies the physicochemical properties and behavior of highly dispersed and macromolecular systems that are widespread in the environment.

Lectures:

1. Basic concepts of physical chemistry. Chemical thermodynamics. Thermochemistry.
2. Kinetics and mechanisms of chemical reactions. Chemical equilibrium.
3. Properties of aqueous solutions of non-electrolytes and electrolytes.
4. Acid-base properties of solutions.
5. Specific and equivalent electrical conductivity of the solution. Conductometry. Electrochemistry.
6. Surface phenomena. Adsorption.
7. Disperse systems and their properties.

Classes:

(practical, laboratory classes)

1. Determining the heat of reaction for the formation of salt crystal hydrate: $CuSO_4 \cdot 5H_2O$.
2. Determining the heat of the reaction of salt crystal hydrate formation: $Na_2CO_3 \cdot 10H_2O$.
3. Determination of the heat of the reaction of neutralization of a strong acid with a strong base.
4. Determination of the dependence of the speed of a chemical reaction on the concentration of reactants.
5. Determination of the dependence of the speed of a chemical reaction on temperature.
6. Determination of the molecular weight of the dissolved substance, the osmotic pressure of the solution and the degree of dissociation of a weak electrolyte by cryoscopy.
7. Conductometric determination of the degree and constant of dissociation of weak electrolytes.
8. Determination of pH of solutions.
9. Conductometric and potentiometric titration. Determination of the buffer capacity of solutions.
10. Measurement of electromotive force of galvanic elements.
11. Research on the adsorption of acetic acid on coal.
12. Determination of the rotational tension of liquids by the stalagmometric method.
13. Production and purification of colloidal systems.
14. Study of coagulation of $Fe(OH)_3$ sol by electrolyte solutions.
15. Study of polymer solutions.

GENERAL ENTOMOLOGY

Department of Entomology, integrated protection and quarantine of plants

Faculty of Plant protection, Biotechnology and Ecology

Lecturer	**Liudmyla Kava**
Term	**3**
Major	**Bachelor degree**
ECTS credits	**8**
Control	**Exam**
Class-room hours	**240 hours (of them: lectures – 60 hours, laboratory classes – 90 hours)**

Subject overview

The cource is desighned to teach students to identify insect, study of insects, their external and internal biulding. After this course student will be able to explain the importance of insects and to use standart keys to idetifying insects to family and subfamily. Basic concepts of entomology such as morphology, taxonomy and systematics, developmental biology, and ecology provide important background information for Agricultural Entomology

Course task:

The protection of plants to reduce or prevent the loss of crop crops from harmful insects in the vegetation period and during storage. The nature of damages and the quantity of ungraded harvest are related not only to pest behavior, but also with the appropriate reaction of the plant to damage caused by its varietal characteristics, economic conditions, etc.

The cource “General Entomology” contributes и to the forming of teorhetical and applied professional skills and achevements of study perfirmence according to which student have:

To know :

1. Species composition of pests spread in Ukraine;
2. How to identify insects based on their morphological features, biological characteristics, damages, their phenology and ecology;

To be able:

1. Explain the importance of insects as members of ecosystems. 2. Gain an appreciation of insect biology, diversity and ecology.
3. Describe the basic anatomy, morphology, taxonomy, development, life histories and key characteristics of different insect groups.
4. Identify common orders and families of insects.
5. Demonstrate the ability to properly collect and curate insects.

Lectures:

1. Introduction. Subject main objectives of the subject "General entomology".
2. Importance of Insects. Evolution and Diversity.
3. External anatomy (exosceleton). The Integument and Cuticular Structures.
4. The Head. Antenae.
5. Mouthpart and modification.
6. Torax (legs, wings and locomotion).
7. Abdomen.
8. Egg Structure. The types of insect's eggs.
9. The types of insect's larva.
10. The types of insect's pupa.
11. Respiratory System of Insects.
12. Circulatory System.
13. Digestive & Excretory Systems.
14. Reproductive System.
15. Nervous System.
16. Endocrine System and hormone.
17. Muscular system of insects and locomotion.
18. Embryogenesis.
19. Morphogenesis.
20. Survival Strategies.
21. Insect Defenses.
22. Population Dynamics.
23. Introduction to Systematics.
24. The Arthropods and Hexapods.
25. Entognatha.
26. Apterygota.
27. Pterygota. Hemimetabola (4 hours).
28. Pterygota. Holometabola (4 hours).

Laboratory classes:

1. Exoskeleton: Definition, Advantages & Examples.
2. The Integument and Cuticular Structures.
3. Types of Insect Head & antennae (Hypognathous, Prognathous & Opisthognathous).
4. Insect Mouthparts.
5. Insect Mouthparts modifications (Biting-Chewing type, Chewing-Lapping type,. Siphoning type, Sponging type, Piercing-Sucking type).
6. Insect Torax.
7. Legs, Wings and locomotion.
8. Insect Abdomen.
9. The Abdominal Structures.

10. Egg Structure. The types of insect's eggs.
11. 5 types of insect's larva.
12. The types of insect's pupa (Exarate pupa, Obtect pupa, Coarctate pupa).
13. Structure of the Respiratory System of Insects.
14. Respiratory System of Aquatic Insects.
15. Structure of the Circulatory System.
16. Structure of the Digestive & Excretory Systems.
17. Structure of the Reproductive System.
18. Structure of the Nervous System.
19. Structure of the Endocrine System.
20. The hormone and and insect molting.
21. Muscular system of insects and locomotion.
22. Embryogenesis.
23. Morphogenesis.
24. Survival Strategies.
25. Insect Defenses.
26. Population Dynamics.
27. Introduction to Systematics.
28. The Arthropods and Hexapods.
29. Entognatha.
30. Sub-Class Apterygota (Oders: Archaeognatha, Zygentoma).
31. Sub-Class Palaeoptera (Oders: Ephemeroptera, Odonata).
32. Sub-Class Paraneoptera (Oders: Hemiptera, Thysanoptera).
33. Sub-Class Paraneoptera (Oders: Phthiraptera, Psocoptera).
34. Sub-Class Endopterygota (Oders: Strepsiptera, Trichoptera).
35. Sub-Class Endopterygota (Oders: Raphidioptera, Siphonaptera).
36. Sub-Class Endopterygota (Oders: Neuroptera, Megaloptera, Mecoptera).
37. Sub-Class Endopterygota (Oder Lepidoptera).
38. Sub-Class Endopterygota (Oder Coleoptera).
39. Sub-Class Endopterygota (Oder Diptera).
40. Sub-Class Endopterygota (Oder Hymenoptera).

GENERAL MYCOLOGY

V.F. Peresypkin Department of Phytopathology

Faculty Plant Protection, Biotechnologies and Ecology

Lecturer	**Havryliuk L., PhD in Biological Sciences**
Term/ Semester	**2/ 3,4**
Major	**Bachelor**
ECTS credits	**6**
Control	**Exam**
Class-room hours	**120 hours (60 h Lectures, 60 h Laboratory classes)**

Subject overview

General mycology is one of the main profiling disciplines in the training of a specialist in plant protection. It is closely related to many general biological and special disciplines: botany, plant physiology, microbiology, soil science, agriculture, plant biochemistry and biotechnology, general and agricultural phytopathology, plant immunity, zoology, general and agricultural entomology, plant breeding, breeding and seed production.

The goal of general mycology as a science is to study the morphological and biological properties and distribution of fungi, their role and significance in human life and economic activity.

In the process of implementing the program, students study the structure of mushrooms, their metabolism, the physiologically active substances they produce, the basics of taxonomy, the peculiarities of ecological groups of mushrooms, their importance in nature and human economic activity.

As a result of studying general mycology, the student should:

to know the task, purpose and objects of general mycology, the structure of mushrooms and their physiological properties, the peculiarities of growth in relation to the substrate, changes in mycelium, its resting stages, reproduction of various groups of mushrooms;

be able to independently determine the group to which fungi belong by the structure of the mycelium (higher, lower), isolate a micromycete and study its growth features, determine the method of reproduction, establish the ability to form an anamorph and teleomorph, find out the conditions of its existence and assign it to the group of parasitism (obligate and facultative saprotrophs and parasites).

Lectures:

1. Structure of fungi. The structure of the vegetative body.
2. Mycelium and its variations of fungi.
3. Fungi as a constituent structure of the vegetative body of lichens.
4. Nutrition of fungi.
5. Fungal metabolism.

6. Biologically active substances of fungi.
7. Geographic distribution of fungi.
8. Ecological groups of fungi.
9. Propagation of fungi. Vegetative.
10. Propagation of fungi Reproductive.

Classes:

(practical, laboratory classes)

1. Microscopic study of fungal cells. Methods of staining the constituent parts of the cell.
2. Study of the morphological structure of the hypha of the fungus. Types of hyphal branching. Vegetative body in yeast fungi.
3. Mycelium structure. Fungal colony. Septated and non-septated mycelium. Morphological structure of appressoria, haustoria and anastomoses, clamp connections and pear-shaped swellings.
4. Resting stages of fungi: oidia, chlamydospores, hemes, films, cords, rhizoctonia, rhizomorphs, sclerotia, their morphological and microscopic structure.
5. Morphological structure of lichens.
6. Laboratory utensils, tools, equipment for laboratory research.
7. Nutrient media, their components. Preparation and sterilization conditions.
8. Cultivation of fungi (influence of temperature and humidity).
9. The concept of "pure culture". Sowing methods for obtaining "pure cultures" of fungi.
10. Fungi growth, growth phases. Determination of fungal growth.
11. Study of the activity of fungal enzymes.
12. Study of antibiotic properties of fungi.
13. Study of toxin-forming fungi.
14. Study of the activity of volatile metabolites of fungi.
15. Study of non-volatile metabolites of fungi.
16. Study of antagonistic properties of fungi.
17. Elucidation of phytotoxic properties of fungi.
18. Soil fungi, methods of their isolation.
19. Identification of species isolated from soil.
20. Air fungi, water fungi, methods of their isolation.
21. Identification of species isolated from air and water.
22. Phytopathogenic fungi, methods of their isolation.
23. Methods of identifying species of fungi that cause plant diseases.
24. Fungi that cause mycosis and mycotoxicosis. Research and identification methods.
25. Endo- and exogenous method of spore formation during asexual reproduction.
26. Sexual reproduction of lower fungi. Planogamy Zygogamy Oogamy.
27. Reproduction of marsupial mushrooms. Formation of bags and ascospores.
28. Yeast reproduction. Fruit bodies of marsupial mushrooms.
29. Reproduction of basidial fungi. Basidia, its structure.
30. Study of the compatibility of the mycelium of basidial fungi.

GENERAL PLANT PATHOLOGY

V.F. Peresypkin Department of Phytopathology

Faculty of Plant Protection, Biotechnologies and Ecology

Lecturer	**Havryliuk L., PhD in Biological Sciences**
Term/ Semester	**3/ 5,6**
Major	**Bachelor**
ECTS credits	**8**
Control	**Exam**
Class-room hours	**150 hours (60 h Lectures, 90 h Laboratory classes)**

Subject overview

"General plant pathology" is one of the main profiling disciplines in training a specialist in plant protection and quarantine. It has a close connection with many general biological and special disciplines: botany, plant physiology, microbiology, virology, biotechnology, soil science, general agriculture, plant breeding, selection and seed production, fruit growing, vegetable growing, agrochemistry, mycology, agricultural phytopathology, zoology, general and agricultural entomology, etc., due to common objects and research methods.

The goal of general phytopathology as a science is to study the pathological process of plants, the etiology of diseases, the role of biotic and abiotic factors in their appearance and development, and to find out the factors that restrain the spread of pathogens and the diseases they cause.

During the implementation of the program, students study various groups of microorganisms pathogenic to plants, their parasitic properties, specialization and systematic position.

The task of general phytopathology is:

- To acquaint students with the pathological process in a plant,
- To study the reasons for the regularity of the spread and development of plant diseases and to be able to establish the influence of environmental factors on these phenomena
- Master the classic and modern methods of diagnosing plant diseases with subsequent identification of their causative agents;
- Based on signs of manifestations on the plant, establish the etiology of the disease;
- Be able to plan and develop preventive and curative measures to prevent plant diseases and reduce crop losses from diseases

As a result of studying general phytopathology, the student should:

to know the diagnostic signs and types of diseases, methods of identification of pathogens, having mastered the theoretical issues of their biology, ecology, systematics and ways of spreading;

to be able to independently determine the types of diseases, establish their causative agents and taxonomic groups, justify measures that prevent the appearance of epiphytotia and limit the development of diseases caused by them.

Lectures:

1. The history of the development of phytopathology.
2. Pathological process and its variability.
3. Harmfulness of plant diseases.
4. Classification of plant diseases.
5. Types of plant diseases.
6. Non-infectious plant diseases.
7. Infectious diseases.
8. Properties of pathogens that determine disease-causing processes in plants.
9. Bacteria and actinomycetes, mycoplasmas and rickettsia.
10. Viruses and viroids.
11. Flower parasites.
12. Morphological, biological and pathogenic properties of lower fungi, their taxonomy.
13. Morphological, biological and pathogenic properties of higher fungi, their taxonomy.
14. Penetration of pathogens into the plant.
15. The influence of environmental conditions on infection.
16. Ways and methods of spread of the infectious beginning.
17. The concept of areas and epiphytotypic diseases.
18. Methods of diagnosing plant diseases. Molecular diagnostic methods.
19. Methods and means of protecting plants from diseases.
20. Compliance with agrotechnical requirements for growing plants.
21. Immunological method of plant protection.
22. Biological method.
23. Physico-mechanical method.
24. Chemical method.
25. Quarantine measures.

Classes:

(practical, laboratory classes)

1. Discoloration of the material, coloring and fixation of preparations. Infection of plants with pathogens. Observation of the development of a living object and pathological changes in a plant.
2. Determining the harmfulness of diseases by their symptoms and distribution.
3. Acquaintance with visual signs of diseases according to their classification.
4. Symptoms of diseases. Types, their manifestation
5. Acquaintance with the symptoms of diseases arising under the influence of abiotic factors.

6. External signs of damage to plant organs by pathogens belonging to different groups of parasitism.

7. The ability of pathogens to infect certain types of plants. The role of minimal infectious load in the occurrence of infection.

8. Morphological features of phytopathogenic bacteria. Types of bacterial plant diseases. Staining of phytopathogenic bacteria, fixation, artificial infection of plants.

9. Morphological properties of actinomycetes, rickettsial mycoplasmas.

10. Symptoms of viral plant diseases. Determining whether the latter belong to the groups of mosaics and yellows. Artificial infection of healthy plants with viral pathogens as evidence of disease infectivity. Diagnosis of plant viral diseases.

11. Morphological features of viroids.

12. Symptoms of mistletoe, coryza and lupus. Mechanism of plant infection.

13. Principles of dividing them into taxonomic groups Class Chytridiomycetes.

14. Sensitivity of lower fungi to abiotic factors. Antagonism of fungi within the species and relative to other organisms. Fundamentals of mushroom taxonomy. The principles of dividing them into taxonomic groups. Class Plasmodiophoramycetes.

15. The principles of dividing them into taxonomic groups Class Oomycetes.

16. The principles of dividing them into taxonomic groups Class Zygomycetes.

17. Signs of mycelium according to which mushrooms belong to higher ones. Penetration into the plant.

18. Systematics of higher fungi. Class Ascomycetes

19. Systematics of higher fungi. Class Basidiomycetes

20. Systematics of higher fungi. Mitosporous fungi

21. Infection of plants with pathogens under different regimes of temperature, moisture and presence of light.

22. Direct and passive transmission of pathogens from diseased plants or their individual organs to healthy ones.

23. Emergence of epiphytotia under different conditions of meteorological condition, pathogen and resistance of varieties (simulate these factors and predict epiphytotia).

24. Methods of diagnosing plant diseases. Laboratory methods of diagnosis

25. Molecular diagnostic methods

26. Simulate various agrotechnical backgrounds affecting the development of certain groups of diseases.

27. The role of the variety in the development of plant diseases. Specify the varieties with increased resistance of various agricultural crops against diseases.

28. The influence of fungi of the second order and their producers on the growth and development of phytopathogenic fungi.

29. Determining the quality of infected and healthy seeds as proof of the need to clean them. Methods of thermal disinfection of seeds.

30. The influence of chemical plant protection agents on the germination of spores and the development of mycelia of pathogens.

MATHEMATICS AND BIOPHYSICS: BIOPHYSICS

Department of Physics

Education and research institute of Energetics, Automatics and Energy saving
Specialty 202 Plant protection and quarantine

Lecturer	**candidate of physical and mathematical sciences, associate professor Oksana Godlevska**
Term	**2**
Major	**Bachelor**
ECTS credits	**3**
Control	**Exam**
Class-room hours	**45 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

The main objective of the course " Biophysics" is to expose principal laws and theses of physics which make it possible to study general regularities of natural phenomena; to apply the principles and methods of the physical sciences to biological problems; to consider the biophysical problems which are concerned with the viability of plants and their interaction with the environment; to elucidate possible application of physical instrumentation to plant protection.

The main requirements to the student after studying by him the course "Biophysics" are the following:

The student must know

the main physical quantities and units, principal laws and theses of general physics, theory and practice of measurement errors;

general physical processes and phenomena which take place in the plants;

the effects of external physical factors on agricultural plant and their interaction with the environment;

possibility of the application of physical instrumentation to plant protection.

The student must be able

to process experimental data and estimate measurement errors;

to explain physical principles and mechanisms of function of plant;

to use modern physical methods and devices in plant protection practice.

Final control is carried out in the form of tests for each of the modules and an exam.

Lectures:

1. Mechanics. Elastic properties of bodies. Biomechanics.
2. Hydrodynamics.
3. Work, power, energy.
5. Acoustics, bioacoustics.
6. Electricity, bioelectricity.
7. Magnetism, biomagnetism
8. Geometric, wave optics. Photobiology of plant.

Classes:

(practical, laboratory classes)

1. Statistical calculations (error, significant figure, rounding).
2. Determining the acceleration of free fall using a mathematical pendulum Determination of Young's modulus of elastic substances.
3. Determination of the moment of inertia of a torsional pendulum.
4. Determination of the rate of sedimentation of bodies and the coefficient of internal friction of a liquid by the Stokes method.
5. Determination of the ratio of specific heat capacities C_p/C_V of gas by the method of adiabatic expansion (Clément-Desormes method).
6. Determination of the surface tension of a liquid by the droplet separation method.
7. Determination of entropy change during melting of tin.
8. Study of the electrostatic field.
9. Determination of the electromotive force of the current source by the compensation method.
10. Determination of the specific charge of an electron using the magnetron method.
11. Determination of the horizontal induction component of the Earth's magnetic field.
12. Determination of refractive indices using a microscope.
13. Determination of the wavelength of light using a diffraction grating.
14. Determination of Planck's constant by the Lukyrskyi method.

NORGANIC AND ANALYTICAL CHEMISTRY

Department of Analytical and Bioinorganic Chemistry & Water Quality

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Ruslan Lavrik**
Term	**1**
Major	**Bachelor**
ECTS credits	**1**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 45 hours, practical or laboratory classes – 60 hours)**

Subject overview

Inorganic and Analytical Chemistry is a fundamental discipline, obligatory for teaching students received the specialties in the field of Plant protection and Quarantine of Higher Educational Agrarian Universities of III-IV accreditation levels. This program was developed on the base of Educational Program of Subject “Inorganic and Analytical Chemistry” for specialty (field) “Plant protection and Quarantine”. In modern society Inorganic and Analytical Chemistry is powerful source of productive powers. In particular, intensification of scientific and technological progress in agricultural and food production requires a rational use of chemical science achievement, intensification of ecological monitoring of economic activity.

So, the main goal of presented discipline is the study of properties, preparation methods and use of chemical elements and their compounds, acquiring the skills for execution. In the result of study the student should.

To know: the classification of inorganic substances and ideas about genetic relationships between them; modern ideas on atomic structure and molecules; basic ideas of RedOx processes; nature, structure, chemical properties of coordination (complex) compounds: formation of skills of chemical analysis using the modeling objects, which will be increased on the real objects of Plant protection and Quarantine fields (plants, fertilizers, water, pesticides, foods etc.).

Lectures:

1. Introduction. General laws of stoichiometry and types of chemical reactions.
2. Atomic structure of chemical elements.
3. The Periodic Law and Periodic Table of chemical elements.
4. Chemical bonding and structure of molecules.
5. Chemical kinetics and equilibrium.
6. Solutions, their nature and properties.

7. Electrolytes and reactions in their solutions.
8. Hydrolysis of salts.
9. Coordination compounds.
10. Redox reactions.
11. Elements of VII-A sub- group.
12. Elements of VI-A sub- group.
13. Elements of V-A sub-group.
14. General properties of metals.
15. Analytical chemistry as a science.
16. Qualitative analysis.
17. Quantitative analysis.

Laboratory classes:

1. General rules of activity in chemical laboratory. Rules of laboratory research.
2. Principles of classification of inorganic compounds and these ranges.
3. Studying of the chemical properties of different types of inorganic compounds.
4. Rules of composition of electronic formulas of the chemical elements, determination of their possible valence and oxidation numbers.
5. Types of chemical bonding and structure of molecules of acids, bases, salts, oxides.
6. Solutions, their nature and properties. Units of concentration.
7. The rules of the chemical reactions compilation in the solutions of electrolytes.
8. The rules of the chemical reactions compilation of the salts hydrolysis and determination of pH.
9. Rules of compilation of red-ox reactions.
10. Rules of compilation of coordinative compounds formulas and reactions with their participation. Studying of their properties.
11. Halogens and their compounds on the example of chlorine and bromine.
12. Oxygen, sulfur and their compounds.
13. Nitrogen, phosphorus and their compounds.
14. Chemical properties of the same metals of main and secondary sub-groups. The first analytical group of cations
15. The second analytical group of cations The third analytical group of cations
16. The forth analytical group of cations. The first analytical group of anions. The second analytical group of anions.
17. The third analytical group of anions. Analysis of unknown substances.
18. Determination of alkali solution normality. Complexometric titration. Permanganatometric determination of Iron (II) content in Mohr’s salt.

ORGANIC CHEMISTRY

Department of General, Organic and Physical Chemistry Department

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Roman Boiko**
Term	**1**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**45 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

The course in organic chemistry should serve as a basis for further study of such special courses as physiology of plants, agrochemistry and soil science, as far as it provides a basis for study of the biochemical processes occurring in plant cells, processes of photosynthesis, metabolism and circulation of organic compounds inside plants, nature of such biological agents as phyto hormones and plant growth inhibitors, synthesized physiologically active compounds, enzymes, vitamins, carbohydrates, proteins, amino acids, nucleic acids, lipids, etc.

This course should provide students with general knowledge of organic chemistry and make them proficient in matters, which are directly related to their speciality. Students should learn general methods of laboratory work with organic substances and should acquire skills of work with laboratory equipment and utensils.

The organic chemistry course precedes the study of the matters dealing with physiology and biochemistry of plants, agrochemistry, soil science, chemical methods of plant protection and techniques of storage and processing of the agricultural products.

Lectures:

1. Subject and role of organic chemistry. Theoretical fundamentals.
2. Alkanes, alkenes, alkynes and. dienes. Their nomenclature, preparation, properties and application.
3. Arenes. Aromacity. Sources of aromatic compounds, their preparation and properties.
4. Monohydroxy, dihydroxy and trihydroxy alcohols. Their classification, nomenclature, methods of preparation and properties.

5. Aldehydes and ketones, structure of their functional group, their isomerism and nomenclature. Reactions of preparation and comparative properties of aldehydes and ketones.

6. Carboxylic acids, their preparation and properties.

7. Carbohydrades. Their natural sources, properties, occurrence and application.

8. Amino acids. Preparation, chemical properties and natural occurrence of amino acids. Peptides.

Laboratory classes:

1. Labour safety rules. General rules of laboratory work. Methods organic matter preparation and purification. Qualitative elementary analysis: identification of C, H, N, S and halogens.

2. Saturated and unsaturated hydrocarbons. Preparation of methane, ethylene and acetylene and study of their properties.

3. Aromatic hydrocarbons (arenes): study of their properties. Terpenes and their properties.

4. Properties of the halogen derivatives of hydrocarbons.

5. Hydrocarbons: modular seminar and written quiz.

6. Properties of alcohols.

7. Properties of phenols.

8. Aldehydes and ketones. Their preparation and properties.

9. Alcohols, phenols, aldehydes and ketones: modular seminar and written quiz.

10. Carboxylic acids. Study of the properties of carboxylic acids.

11. Esters and fats. Saponification of fats. Carboxylic acids. seminar and written quiz.

12. Study of mono- and disaccharides.

13. Properties of polysaccharides: hydrolysis of starch and cellulose, test for lignin.

14. Properties of amines and amides.

15. Amino acids and proteins. Study of their properties.

PLANT PHYSIOLOGY WITH BASICS OF BIOCHEMISTRY

Department of physiology, biochemistry of plants and bioenergetics

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Andriy BABYTSKIY**
Term	**Semester 4**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

The purpose of studying the discipline "Plant Physiology with the basics of biochemistry" is to learn the laws of vital functions of plants, the disclosure of their mechanisms, forming an idea of structural and functional organization of plant systems at different levels and developing ways to control the plant organism.

Course objectives

1. Study of plant cell physiology – chemical and molecular composition of the cell, its structural components.

2. The study of the vital processes of the plant organism – water regime, photosynthesis, respiration, mineral nutrition.

3. Finding out the peculiarities of growth and development of the plant organism.

4. Study of physiology of reproduction, adaptation and mechanisms of plant stability, physiology of stress.

As a result of studying the discipline the student has to

know: physiological characteristics of the plant cell, the relationship of water regime with physiological processes; to have modern ideas about the mechanisms of photosynthesis, respiration, mineral nutrition To have physiological laws of growth processes. The student must have the basics of biotechnology – the theoretical foundations of creating nutrient media and models of microclonal reproduction.

be able: apply the acquired knowledge of plant physiology in solving practical problems, develop and conduct research on plant physiology; understand the physiological processes of the plant organism and have a scientific, professional approach to the technology of growing agricultural crops.

Acquisition of competencies:

general competencies (GC):

Ability to apply knowledge in practical situations.

professional (special) competencies (PC):

Ability to assess phytosanitary risks (biological, environmental, economic) due to the introduction or spread of regulated pests.

Ability to solve a wide range of problems and challenges in the process of growing crops, understanding their biological characteristics and the use of both theoretical and practical methods

Lectures:

1. Introduction. Subject, purpose and tasks, directions and methods of modern plant physiology. History of the formation of plant physiology as a science.
2. Cell membrane and membranes.
3. Organelles and vacuoles.
4. Chemical composition of plant cells.
5. Water exchange of plants.
6. General concept of photosynthesis.
7. Light phase of photosynthesis.
8. Dark phase of photosynthesis.
9. Plant respiration (Glycolysis-Krebs cycle-RETC).
10. Alternative ways of oxidation of substrates.
11. Mineral nutrition of plants.
12. Physiology of excretion of substances by a plant.
13. Basic patterns of plant growth and development.
14. Regulation of plant growth and morphogenesis.
15. Physiology of plant stability.

Classes:

(practical, laboratory classes)

1. Plant cell structure.
2. Determination of membrane permeability.
3. The phenomenon of plasmolysis and deplasmolysis in plant cells.
4. Determination of sucrose activity.
5. Determination of water absorption rate by a plant.
6. Determination of the condition of the stomata by infiltration.
7. Determination of suction force of plant tissues by the method of strips.
8. Dependence of transpiration intensity on environmental conditions.
9. Physico-chemical properties of pigments.
10. Distribution of pigments by paper chromatography.
11. Determination of chlorophyll concentration by photocolorimetric method.
12. Determination of the intensity of photosynthesis by gasometric method.
13. Detection of enzymes of oxidative electron transport chains.
14. Determination of plant respiration intensity.
15. Microchemical analysis of ash.

PLANT PRODUCTION WITH BASICS OF FEED PRODUCTION AND AGROMETEOROLOGY

Department of Crop Production

Agrobiology Faculty
Specialty 202 Plant protection and quarantine

Lecturer	
Term	
Major	**Bachelor or Master degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours)**

Subject overview

Discipline "Plant Production with Basics of Feed Production and Agrometeorology," issues of theoretical and technological preparation in the cultivation of major agricultural crops of various purposes are considered, as well as the basics of professional knowledge necessary for analyzing climatic and weather conditions during the period of plant growth and development. The learning outcomes include the ability of specialists to form objective conclusions and recommendations regarding the adjustment of cultivation technologies for annual and perennial crops to achieve maximum environmentally friendly yields. Requirements of state standards for the quality of plant products and ways to improve it are discussed, measures to reduce crop losses during harvesting, transportation, post-harvest processing, storage, and preservation are studied.

Lectures:

1. Winter cereals: general characteristics (wheat, rye, triticale, barley).
2. Spring cereals: early spring cereal crops (wheat, barley, oats).
3. Late spring cereals (corn, millet, sorghum, foxtail millet, rice, buckwheat).
4. Grain legumes (peas, soybeans, beans, lentils, chickpeas, lupins, fodder legumes).
5. Root crops (fodder beets, carrots, turnips, fodder rutabagas, kohlrabi).
6. Tuber crops (potatoes, Jerusalem artichokes).
7. Squashes (watermelons, pumpkins, zucchinis).
8. Sugar crops (sugar beets).
9. Oil crops (sunflower, rapeseed, oil poppy, etc.).
10. Essential oil crops (coriander, cumin, fennel, mint, sage, etc.).

11. Fiber crops (flax, hemp, cotton).
12. Aromatic crops (hops, tobacco, sweet clover).
13. Energy crops (plants for various fuel production: biodiesel, bioethanol, solid fuels).
14. Field forage production.
15. Pasture forage production.
16. Harvesting and preservation of silage.
17. Major agrometeorological factors and ways of their effective utilization in agriculture.
18. Climate and its importance for agriculture. agrometeorological forecasts.

Classes:
(practical, laboratory classes)

1. General characteristics of grain crops.
2.Morphological characteristics of grain crops.
3. Botanical and morphological characteristics of wheat, rye, triticale, barley, oats: species and their characteristics.
4. Corn, sorghum, rice, buckwheat: morphological features, description based on natural samples.
5. General characteristics of grain legumes (peas, soybeans, lupins).
6.Tubers: potatoes – botanical characteristics.
7.Root crops: fodder beets – morphological structure of plants' organs in the first and second years of growth.
8.Squashes (watermelons, zucchinis, pumpkins).
9.Sugar crops: sugar beets – morphological features, anatomical structure of the root.
10.Oil crops: sunflower – determination of oil crops by seeds, fruits, and seedlings. Agrobiological monitoring of growth and development.
11.Essential oil crops: general characteristics, determination by seeds, fruits, and seedlings. systematics and determination of morphological features.
12.Fiber crops: general characteristics, systematics, and determination of morphological features of roots, stems, fruits, seeds. anatomical structure of flax and hemp stems.
13.Aromatic crops: systematics and study of morphological features of hops, tobacco, sweet clover.
14.Energy crops: systematics and determination of characteristics of energy plants for various types of biofuels.
15.Feed classification: comparative evaluation of different feed groups.
16.Grain and legume grain crops: significance, feed value, use in feed production system, and preparation for feeding.
17.Silage, non-traditional feed crops, and intermediate crops.
18.Root, tuber, and squash crops.
19.Characteristics of main forage grasses and pastures.

20.Composition of forage mixtures.

21.Organization of agrometeorological observations: general characteristics of instruments for measuring meteorological parameters.

22.Measurement of solar radiation flux intensity: calculation of direct, diffuse, total, and photosynthetically active radiation.

23.Air temperature measurement: structure and analysis of annual temperature graph.

24.Soil temperature measurement: determination of soil freezing depth.

25.Determination of basic air humidity characteristics.

26.Measurement of atmospheric pressure and wind speed.

27.Calculation of agroclimatic indicators for the region.

SOIL SCIENCE WITH THE BASICS OF GEOLOGY

Department of Soil Science and Soil Conservation Department

Faculty of Plant Protection, Biotechnology and Ecology

Lecturer	**Yuriy Kravchenko**
Term	**3**
Major	**Bachelor**
ECTS credits	**3**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, practical or laboratory classes – 30 hours)**

Subject overview

This course is an introductory designed course for the Bachelor student, which provides the basic concepts of all aspects of geology and soil science. It encompasses: Earth's origin; internal and external Earth's dynamics; minerals and rocks – formation, composition, diagnostics and properties changes; agronomic ores properties and application; anthropogenic influence on geologic environment. The course presents the soil composition and genesis; physical, chemical, and biological properties; soil water; classification and mapping; soil conservation; management practices; and soil fertility and productivity (soil testing, use of fertilizers and liming), soil quality assessment. The course gives practical experience as an aid in developing understanding of the minerals, rocks and soils as natural bodies, the use of which has an influence on environmental, human society and life in general.

Lectures:

1. The Earth and geological processes.
2. Soil formation and soil processes.
3. Soil classification, taxonomy and morphology.
4. Soil physics.
5. Soil chemistry.
6. Zonal soils of Ukraine.
7. Azonal and intrazonal soils of Ukraine.

Laboratory classes:

1. Diagnostics of Physical Properties of Minerals.
2. Forms (categories) of soil water. Soil hygroscopic moisture determination.
3. International pipette method of soil texture determination.
4. Soil organic matter determination.
5. Soil acidity determination.
6. Cation exchange capacity determination.
7. Soils of Ukraine.