### 1. COURSE DESCRIPTION – GENERAL INFORMATION

<table>
<thead>
<tr>
<th>1.1. Course teacher</th>
<th>Professor Željan Maleš, PhD</th>
<th>1.6. Year of study</th>
<th>1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2. Name of the course</td>
<td><strong>Pharmaceutical botany</strong></td>
<td>1.7. Credit value (ECTS)</td>
<td>7.5</td>
</tr>
<tr>
<td>1.3. Associate teachers</td>
<td>Associate Professor Kroata Hazler Pilepić, PhD Maja Črkvenčić, Assistant</td>
<td>1.8. Type of instruction (number of hours L+E+S+e-learning)</td>
<td>30+30+15</td>
</tr>
<tr>
<td>1.4. Study programme (undergraduate, graduate, integrated)</td>
<td>Pharmacy integrated study programme</td>
<td>1.9. Expected enrolment in the course</td>
<td>130</td>
</tr>
<tr>
<td>1.5. Status of the course</td>
<td>Compulsory</td>
<td>1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)</td>
<td>2.</td>
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</tbody>
</table>

### 2. COURSE DESCRIPTION

#### 2.1. Course objectives

Students will learn the fundamentals of general and special botany with special emphasis on medicinal plants. The knowledge and skills obtained will serve as basis for courses Pharmacognosy I and Pharmacognosy II.

#### 2.2. Enrolment requirements and required entry competences for the course

There are no requirements for enrolment. However, it is expected that students have passed high school level course of biology.

#### 2.3. Learning outcomes at the level of the study programme to which the course contributes

Knowledge of pharmaceutical botany obtained is necessity in:

- Defining procedures related to research, development, production, analysis and quality control of herbal medicines.

#### 2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)

After passing the course the student will be able to:

1. Explain the basic concepts of botany;
2. Define and compare the types and roles of plant tissues;
3. Define the morphological and anatomical characteristics of vegetative and generative plant organs;
4. Describe the functions of plant organs;
5. Describe the processes of pollination, fertilization and dispersal of seeds and fruits;
6. Differentiate and identify the species of selected families with special emphasis on medicinal plant species;
7. Perform microscopic analysis of plant tissues and organs.

#### 2.5. Course content broken down in detail by weekly class schedule (syllabus)

**LECTURES:**

- Introduction to the course, Division of botany, Structure and secondary changes of the cell wall, Secondary metabolites;
• Aleurone granules, The crystals of calcium oxalate, Introduction to histology, Primary and secondary dermal tissues, Ground tissues;
• Mechanical tissues, Vascular (transport) tissues, Glandular (secretory) tissues, The function of the root and root zones, Primary structure of root;
• Secondary structure of root, Stem - function and types, Primary and secondary structure of stem;
• Leaf - function, division and anatomy; Growth, development and reproduction of plants; The life forms of plants;
• The function and parts of flower, Flower formula and diagram, Types of inflorescences, Pollination and fertilization;
• Characteristics of fruits, Dispersal of seeds and fruits, Introduction to plant systematics, Prokaryotes;
• Algae, Fungi, Lichens, Mosses, Ferns;
• Gymnosperms, Characteristics and representatives of the orders Magnoliales, Piperales, Ranunculales, Papaverales and Fagales;
• Characteristics and representatives of the orders Urticales, Rosales, Fabales, Myrtales, Rutales, Geraniales, Rhamnales, Euphorbiales and Santalales;
• Characteristics and representatives of the orders Apiales, Theales, Capparales and Malvales;
• Characteristics and representatives of the orders Ericales, Primulales, Caryophyllales, Polygonales and Gentianales;
• Characteristics and representatives of the orders Dipsacales, Oleales, Polemoniales, Scrophulariales and Lamiales;
• Characteristics and representatives of the order Asterales;
• Monocotyledons – orders Zingiberales, Liliales, Orchidales, Poales and Arales;

SEMINARS:
• Medicinal plant species – fresh plant material and herbarium material;
• Root transformations, Above-ground stems, Stem position;
• Above-ground and underground stem transformations, Phylloclades, Leaf - shapes and venation, Leaf disposition and transformations;
• Eucarpia - dry fruits – dehiscent fruits;
• Eucarpia - dry fruits – indehiscent fruits and loments;
• Eucarpia - fleshy fruits and pseudocarpia (accessory fruits);
• Brown and red algae, Cones of the species of the family Pinaceae, Fruits of the plants of the family Cupressaceae;
• Fruits of the plants of the order Magnoliales, Fruits of the plants of the family Fagaceae;
• Tropical plant species;
• Pharmaceutical Botanical Garden "Fran Kušan" – getting acquainted with characteristics of the garden and disposition of plant species;
• Pharmaceutical Botanical Garden "Fran Kušan" – study of Gymnosperms;
• Pharmaceutical Botanical Garden "Fran Kušan" – study of Dicotyledons: orders Magnoliales, Piperales, Ranunculales, Papaverales, Fagales, Urticales, Rosales, Fabales, Myrtales, Rutales, Geraniales, Rhamnales,
**Euphorbiales and Santalales;**
- Pharmaceutical Botanical Garden "Fran Kušan" – study of Dicotyledons: orders Apiales, Theales, Capparales, Malvales, Ericales, Primulales, Caryophyllales and Polygonales;
- Pharmaceutical Botanical Garden "Fran Kušan" – study of Dicotyledons: orders Gentianales, Dipsacales, Oleales, Polemoniales, Scrophulariales, Lamiales and Asterales;
- Pharmaceutical Botanical Garden "Fran Kušan" – study of Monocotyledons.

**LABORATORY EXERCISES:**
- Plant histology: ground tissue (*Ricinus, Clematis*);
- Plant histology: dermal tissue (*Rheo, Vanilla, Elegnus, Verbascum, Sambucus*);
- Plant histology: vascular (transport) tissue (*Cucurbita, Pinus*);
- Plant histology: mechanical tissue (*Rumex, Pirus, Tilia*);
- Plant histology: glandular (secretory) tissue (*Myrtus, Euphorbia, Mentha*);
- Plant anatomy: stem (*Zea, Ranunculus, Tilia, Pinus*), root (*Iris*);
- Plant anatomy: leaf (*Pinus, Iris, Helleborus*);
- Plant systematics: algae (*Fucus*), lichens (*Cetraria*), mosses (*Politrichum*);
- Plant systematics: ferns (*Equisetum, Polypodium*);
- Plant systematics: gymnosperms (*Taxus, Juniperus*), angiosperms (*Magnolia*);
- Plant systematics: angiosperms dicotyledons Papaverales, Fabales, Rosales (*Chelidonium, Laburnum, Crataegus*);
- Plant systematics: angiosperms Rhamnales, Rutales, Capparales (*Frangula, Ruta, Alliaria*);
- Plant systematics: angiosperms Primulales, Gentianales (*Primula, Vinca*);
- Plant systematics: angiosperms Araliales, Lamiales, Scrophulariales (*Carum, Salvia, Digitalis*);
- Plant systematics: angiosperms monocotyledons Liliales, Poales (*Allium, Secale, Iris*).

### 2.6. Type of instruction

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Seminars</th>
<th>Workshops</th>
<th>Independent study</th>
<th>Laboratory</th>
<th>Online learning</th>
<th>Fieldwork</th>
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<tbody>
<tr>
<td><strong>exercises</strong></td>
<td><strong>and workshop</strong></td>
<td>online in entirety</td>
<td><strong>multimedia and the internet</strong></td>
<td><strong>work with the mentor</strong></td>
<td><strong>(other)</strong></td>
<td></td>
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</table>

### 2.8. Student responsibilities

Attendance of lectures, seminars and laboratory exercises is mandatory.

### 2.9. Screening of student’s work

(Specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)

<table>
<thead>
<tr>
<th>Class attendance</th>
<th>1</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental work</td>
<td>1</td>
<td>Report</td>
</tr>
<tr>
<td>Essay</td>
<td>0.5</td>
<td>Seminar essay</td>
</tr>
<tr>
<td>Tests</td>
<td>4</td>
<td>Oral exam</td>
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<tr>
<td>Written exam</td>
<td>Project</td>
<td></td>
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</tbody>
</table>

2.7. Comments:
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<tr>
<th>2.10. Grading and evaluation of student work over the course of instruction and at a final exam</th>
<th>Practical and written preliminary exam. Recognition of plant species present in the Pharmaceutical Botanical Garden &quot;Fran Kušan&quot;. Recognition of dry plant material (fruits, underground organs). Oral exam.</th>
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</thead>
<tbody>
<tr>
<td>2.11. Required literature (available at the library and via other media)</td>
<td>Title</td>
</tr>
<tr>
<td>2.12. Optional literature (at the time of the submission of the study programme proposal)</td>
<td>Title</td>
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<tr>
<td>2.13. Methods of monitoring quality that ensure acquisition of exit competences</td>
<td>Learning outcomes 1-5 are assessed by oral exam and learning outcomes 6-7 with practical exam after laboratory exercises.</td>
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