

# Master's programme in Precision Animal Health

at the University of Veterinary Medicine, Vienna  
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## 1. General terms

### 1.1. Legal basis

The legal basis for this master's programme is the Austrian Universities Act (*UG 2002*).

### 1.2. Qualifications profile

#### 1.2.1. General qualifications

Digitalisation has already also found its way into the field of animal husbandry and veterinary medicine by means of innovative applications of information and communication technologies. This is the source of disruptive change in diagnostic and communication options for veterinarians, as well as those who care for animals, which can be used in improving animal health and well-being. In the context of the veterinary care of livestock, the deployment of modern technologies in combination with artificial intelligence is playing a central role in the resource-sensitive and responsible production of animal-based foodstuffs, while at the same time improving animal health and well-being (smart farming). Veterinarians are taking on a key role here in the interpretation of complex data analyses and automated procedures.

This historical opportunity to participate in this innovative and not only technical trend is critically dependent on the availability of suitably educated and trained specialists whose knowledge and expertise contribute to achieving such an expansion of animal care and veterinary services while also taking into account the socio-economic consequences for the veterinary professional, animal owners and animal health (animal care chain).

In order to contribute, by educating precisely these necessary specialists and experts, the University of Veterinary Medicine, Vienna, in collaboration with the University of Applied Science Upper Austria and the Federal Secondary School and Research Institute for Agriculture Raumberg-Gumpenstein, offers the master's programme Precision Animal Health.

This master's programme is designed for students interested in further education at the interface between veterinary medicine, animal husbandry, animal production and modern, information-driven technologies.

During the master's programme, students acquire skills which enable them:

- to understand and explain the technological basics and principles underlying the application of information-driven technologies in the areas of veterinary medicine, animal husbandry and agricultural production,
- to translate the principles, needs and challenges of agricultural production and farming (with a core focus on livestock management) into the related technical language, to communicate with technical specialists and, as a result, to significantly facilitate technical innovation and solutions,
- to be involved in the development, implementation and distribution of new technology-based solutions along the animal care chain,
- to undertake specialist foundational, interdisciplinary and applied research at universities (PhD), universities of applied sciences and non-university research institutions in the area of digital animal health management and in collaboration with farms and companies in the agricultural sector and related industries,

- to rely on facts to reliably estimate the impacts of the use of precision animal health technologies in terms of socio-economic and ethical aspects as well as the goal of ensuring a sustainable and efficient use of resources.

## **1.2.2. Professional fields**

On the grounds of their education, graduates of the master's programme Precision Animal Health will be able to take on management roles, for example in the following areas:

- Product development and research in veterinary technical and agricultural technical areas (in the private and public sectors)
- Specialist consulting for farms in terms of the deployment of smart farming technologies
- Consulting in the area of herd management at livestock farms
- Universities and other post-secondary educational institutions
- Non-university research institutions

## **1.2.3. Specialist and key qualifications will be acquired in the following fields:**

- Supporting digital transformation processes in veterinary medicine and farming
- Capturing digitalised agricultural data on the production of animals and animal products
- An understanding and the application of sensor-based systems
- Digitalised monitoring and management in animal husbandry
- The assessment of animal health and production-related data over time
- The solution-oriented translation of requirements into technologies and applications
- An understanding and the evaluation of ethical questions related primarily to livestock and companion animals as well as in livestock production in connection with digitalisation
- Data and process analysis related to agricultural systems
- Technology assessment

### 1.3. Internationality and language

This master's programme has been structured and designed based on international standards. The recognition of sufficient academic progress is guaranteed by applying the ECTS system.

The language of instruction of the master's programme is English, whereby certain electives may be taught in German. It is therefore necessary for students to demonstrate English-language skills at the B2 level of the Common European Framework of Reference for Languages.

Electives, internships and the master's thesis can also take place at other Austrian or foreign post-secondary educational institutions or recognised research institutions.

### 1.4. Outline, scope and duration of the master's programme

The master's programme encompasses a total of four semesters consisting of courses (mandatory and elective, including examinations), internships and preparing a master's thesis, making up a total of 120 ECTS credits.

The European Credit Transfer and Accumulation System (ECTS) serves to simplify the inter-university and inter-European accreditation of academic performance. Every course is allocated ECTS credits based on the scope of academic work required from students (both related to courses and self-study). Internships and master's thesis are also allocated ECTS credits. An ECTS credit is equivalent to 25 hours of work and is based on the average workload required in order to achieve the anticipated academic objectives.

ECTS credits are awarded to mandatory courses (including examinations), electives, internships, the master's thesis and the master's examination as follows:

<b>Mandatory courses</b>	<b>Electives</b>	<b>Internship</b>	<b>Master's thesis and master's examination</b>	<b>Total</b>
<b>ECTS credits</b>				
69	9	12	30	120

The scope of lectures and other courses is defined in semester hours and ECTS credits. Based on a semester extending for a period of 15 weeks, one semester hour is equivalent to 15 academic hours each of 45 minutes in duration.

### 1.5. Preconditions for admission to the master's programme

Admission to the master's programme Precision Animal Health is dependent on the successful completion of a relevant bachelor's degree at a university or university of applied sciences or an equivalent degree with a scope of at least 180 ECTS credits at an accredited domestic or foreign post-secondary educational institution.

Relevant in this context relates to a degree in veterinary medicine, agricultural sciences as well as the fields of agriculture and agrarian technology, information sciences, biology, human medicine and medical technology.

## 2. Teaching and lecturing formats

### 2.1. Teaching formats

#### **Courses not based on continuous assessment**

*Lectures (VO)* aim to convey knowledge and form the basis for subsequent courses.

#### **Courses based on continuous assessment**

*Conversatoriums (KV)* aim to convey knowledge by means of suitably and competently managed discussions as well as the training of problem-solving skills. Discussion group sessions are teaching elements based on continuous assessment in which particular credit is given to active involvement.

*Seminars (SE)* facilitate scientific discussion. Active involvement on the part of students is demanded in the course of tutorials, with these small groups focussing in particular on applying their knowledge to analyse and address questions and issues. Verbal and/or written contributions will be required from students.

*Exercises (UE)* aim to convey practical and special career-related skills.

*Internships (PR)*: The aim of internships is to provide students of the master's programme with practical insights into companies and institutions in which technologies associated with digital animal health management are developed, applied or tested. Further objectives include promoting an understanding and the evaluation of ethical issues in the context of digitalisation primarily related to ruminants, swine, horses, small animals and in agricultural production.

### 2.2. Course attendance limits

The group size for curricula courses based on continual assessment is limited to 20 students (maximum group size = 20). If necessary, this limit may be marginally exceeded.

### 2.3. Electives

The degree programme includes 9 ECTS credits which are to be earned by completing courses which can be freely selected by students (electives). These courses can be selected from the entire range of courses offered by all accredited national or international universities. Electives aim to convey knowledge and skills in both related fields as well as areas of general interest.

## 3. The master's programme

### 3.1. Module descriptions

#### **Module 1 – Monitoring Animal Health**

The first module focuses on the basics of monitoring animal health. Students learn which psychological and biological processes and characteristics are relevant in order to identify disorders related to the animal well-being and health, and which options exist for describing these. Students learn a range of comparative diagnostic techniques and methods in order to develop, evaluate or validate automated monitoring systems. This module also explains technical systems for capturing animal-related parameters and presents the latest research fields and findings. The application of digital technologies also has an impact on other areas of animal husbandry as well as human-animal interactions. These aspects are addressed in Module 1 and covered in more depth in later modules.

#### **Module 2 – Capturing Data and Parameters**

The technical capturing of data and parameters forms the basis for digital monitoring. This module presents relevant technologies used in research and practice in order to capture data related to animals and their environments as the key to monitoring animals and calculating relevant parameters. Students learn to identify how systems function and, upon completion of the module, can explain the system components as well as the principles of data capture and transfer.

#### **Module 3 – Data Processing and Analysis**

This module conveys the basics of data protection and data security as important components of data management. Furthermore, students acquire an understanding of how databases work and prepare database models using the relevant programming languages and development environments. Fundamental relevant statistical methods are explained and applied by students to initially analyse captured data and research findings.

#### **Module 4 – Data Sources and Management**

The origin of the data captured, searches of data sources, the reliability of data quality and the secure management of data are essential principles of good data management. In this module, students learn the underlying principles of managing data as well as the use of data and data security in addition to considering the legal aspects related to exploiting data. They also learn how to use data sources and databases. They practice preparing data records for subsequent use and how to safeguard high levels of data security in connection with the monitoring and digital management of individual animals and herds. Students develop their knowledge of statistical data record processing to an advanced level.

#### **Module 5 – Monitoring Systems**

Image-processing systems play a central role in digital monitoring. During this module, students learn the physical and technical basics of sensor-based imaging systems as well as automated image analysis. The use of artificial intelligence to analyse data and the modelling of dynamic system plays an important role both in analysing images as

well as in other areas of digital monitoring. Students learn the basics of modelling as well as various models and simulations for forecasting purposes, e.g. related to animal diseases.

## **Module 6 – Applications of Precision Animal Health Management**

During this module, students calculate and interpret animal-related data which act as target values for, inter alia, the use of digital technologies. Monitoring and animal-tracking methods and technologies currently in use are presented in addition to discussing deployment areas as well as the respective advantages and disadvantages.

## **Module 7 – Applications and Implementation**

In this module, students learn how to deploy the systems used in precision animal health monitoring in the management of individual animals and livestock. They use relevant systems and interpret the automatically captured data with the aim of identifying factors detrimental to animal well-being and disease symptoms at an early stage. This involves students gaining a deeper understanding of and honing their skills in the statistical analysis of data and forecasting models. They develop models and concepts of how to integrate the information gathered in management decisions and how these can be conveyed to animal owners.

Interdisciplinary team-based projects provide students with practical and research-oriented insights into the work of institutions involved in the teaching. They are actively involved in the development and implementation of joint projects and also present these.

## **Module 8 – Innovation and Society**

Besides application and consulting, the development and further development of digital technologies for monitoring and managing individual animals or livestock form an important career-related area for graduates. This module provides students with knowledge about the opportunities and basics of founding companies and innovation management. Students also learn how to discuss the ethical aspects and social consequences of digital transformation based on facts.

## 3.2. Recommended arrangement of semesters and courses

### 1st Semester

Module / Course	VO	KV	SE	UE	ECTS credits
	Semester hours				
<b>Module 1 – Monitoring Animal Health</b>					<b>10</b>
Principles of animal physiology, ethology, pathology and diagnostics	2				2
Assessing animal behaviour and well-being				0.7	1
An introduction to animal health monitoring and animal well-being in livestock and companion animal management	3				3
The use of precision monitoring in animal research	2				2
Socio-economic aspects I	1				1
		1			1
<b>Module 2 – Capturing Data and Parameters</b>					<b>6</b>
Hardware principles	2				2
Capturing parameters		3			3
Introduction to remote technologies (sensing, WiFi, GNSS/GPS)	1				1
<b>Module 3 – Data Processing and Analysis</b>					<b>10</b>
Data law, IT security and technical data protection I	1				1
Information technology basics IT I	2				2
Information technology basics IT II				1	1.5
Scripting basics and practice		1			1
			1		1.5
Statistics I		1			1
				1.3	2
<b>Further courses / examinations</b>					
Electives					4
<b>Total</b>	<b>14</b>	<b>6</b>	<b>1</b>	<b>3</b>	<b>30</b>

## 2nd Semester

Module / Course	KV	SE	UE	ECTS-AP
	Semester hours			
<b>Module 4 – Data Sources and Management</b>				<b>7</b>
Data sources and databases	2			2
Data quality and preparation	0.8			1
			1.5	2
Statistics II			0.7	1
Data law, IT security and technical data protection II	1			1
<b>Module 5 – Monitoring Systems</b>				<b>4</b>
Image-processing systems; capture and analysis	2			2
Modelling, system/process analysis, forecasting models and decision support	2			2
<b>Module 6 – Applications of Precision Animal Health Management</b>				<b>8</b>
Analysing and interpreting animal health data and agricultural data		2		3
Current applications of precision animal health and smart farming I	1			1
			2	3
Socio-economic aspects II		0.7		1
<b>Other courses / components</b>				
Internship				9
Electives				2
<b>Total</b>	<b>8.8</b>	<b>2.7</b>	<b>4.2</b>	<b>30</b>

## 3rd Semester

Module / Course	KV	SE	UE	ECTS credits
	Semester hours			
<b>Module 7 – Applications and Implementation</b>				<b>20.5</b>
Precision measurement, monitoring & management – housing, feeding, animal, transport & processing	2			2
Current applications of precision animal health and smart farming II			3.5	5
Statistics III			0.7	1
Implementing consultancy and application concepts in discussions with animal owners		1		1.5
Interdisciplinary team projects			7.3	11
<b>Module 8 – Innovation and Society</b>				<b>3.5</b>
Founding companies and innovation management	1			1
Technology impact assessments: Application, acceptance, sustainability and social aspects	1			1
Ethical aspects		1		1.5
<b>Other teaching / courses</b>				
Practical				3
Electives				3
<b>Total</b>	<b>4</b>	<b>2</b>	<b>11.5</b>	<b>30</b>

## 4th Semester

Master's thesis	ECTS credits
Master's thesis	27
Master's examination	3
<b>Total</b>	<b>30</b>

## 4. Master's programme examination regulations

The examination regulations of this master's programme are based on Articles 72 ff of the Austrian Universities Act (*UG 2002*) and the legal aspects of the statutes of the University of Veterinary Medicine, Vienna.

The examiner is generally the lecturer whose course a student has attended.

The master's programme Precision Animal Health is considered to have been successfully completed when the following preconditions have been met:

- The successful completion of the modules prescribed in the curriculum
- The successful completion of sufficient electives to accrue the required number of ECTS credits
- The successful completion of the internship
- The successful completion of the master's thesis
- Passing the master's examination

### 4.1. Examination formats

#### 4.1.1. Course examinations

Courses based on continuous assessment

Continuous assessment courses are courses in which the grade is based on several written and/or oral assignments on the part of participants during the course.

#### 4.1.2. Module examinations

Academic performance related to the modules is assessed by means of module examinations. Module examinations are exams aimed at establishing the acquisition of the knowledge and skills taught in a module.

##### 4.1.2.1. Modules with lectures and based on continuous assessment

In the case of modules based on lectures and continuous assessment, a written module-specific exam takes place in the form of a single assessment procedure and includes the contents of the relevant lectures.

The following written question formats may be used: Multiple choice (MC) question formats (MCQ Type A (single select questions), MCQ Pick-N (multiple select questions), cloze test questions (drop-down menu) and other question formats (short-answer question (SAQ), image diagnosis question, image allocation question, classification question) and the key-feature examination format.

A positive grade for the courses based on continuous assessment forming part of a module is the precondition for sitting the relevant module examination.

A module is considered to have been successfully completed if the module examination and the related courses based on continuous assessment have been successfully completed.

#### **4.1.2.2. Modules with courses based on continuous assessment**

In the case of a module which is based entirely on one or several continuous assessment courses, the module is considered to have been successfully completed if all of the related courses have been successfully completed.

#### **4.2. Master's examination**

The successful completion of all the modules, internships and electives, to the extent defined in the curriculum, as well as a positive grade on the master's thesis form the preconditions for admission to the master's examination.

The master's examination consists of an oral exam with a defence held before an examination board.

#### **5. Internship**

The internship must take place between semesters and encompasses a total of eight weeks, broken down into two 4-week blocks. It is recommended to undertake the internship after the second and third semesters respectively. Internships are intended to provide students with insights into farms, companies or organisations which apply, develop or test precision animal health or smart farming technologies. The internships can take place at the University of Veterinary Medicine, Vienna, at other domestic or foreign post-secondary educational institutions as well as at relevant external institutions (e.g. research institutes, private companies, practices and farms). The competent university body decides on the approval of an institution or organisation as an authorised provider of internships.

#### **6. Master's thesis**

The master's thesis is an academic paper dedicated to a scientific issue which is to be completed in the course of a master's programme. By means of their master's thesis, students demonstrate that they are capable of independently addressing a scientific issue in a manner which is academically sound in terms of its contents and methodology. The topic and scope of the master's thesis is to be selected such that it is plausible and possible to complete this within a period of six months.

Master's theses are to be written in English and should cover a topic which has been addressed in the modules taught during the degree programme. It is recommended that students integrate, expand and critically evaluate the knowledge and experience gained during the course of their internship in their master's thesis.

Master's theses are a scientific piece of academic work the format and scope of which are defined in the policy on the preparation of master's theses.

It is permissible to work in collaboration with several other students provided that the performance of each student can be evaluated separately.

In accordance with Article 73 (1) of the Austrian Universities Act (*UG 2002*), master's theses are graded as very good (1), good (2), satisfactory (3), pass (4) or fail (5).

#### **7. Graduation**

Graduates of the master's programme Precision Animal Health are awarded the academic degree Master of Science, abbreviated as MSc.

A graduate of the master's programme Precision Animal Health is eligible to commence a doctoral programme (PhD).

**8. Validity**

This curriculum comes into effect on 01.10.2022.