



**MASTERS DEGREE PROGRAM  
AT THE UNIVERSITY OF VIENNA**

**Quantitative Economics,  
Management, and Finance  
(abbreviated as QEM -  
Quantitative Economics Master)**

**§ 1 Aims of the program and qualifications profile**

(1) The aim of the masters degree program QEM at the University of Vienna is to impart to the students the knowledge and skills required to analyze business, economics and statistics issues using mathematical models and to apply mathematical methods in the fields of business, economics and statistics.

Building on a quantitative natural sciences-oriented bachelors or diploma degree program, the masters degree program QEM offers a sound qualification in business, economics and statistics.

The graduates of the masters degree program at the University of Vienna thus have a comprehensive business, economics and statistics qualification with consolidated specialized knowledge of quantitative and computational methods in one of the following areas: economics, finance, management, operations research.

(2) The students acquire a methodological-scientific qualifications profile, which enables them to take on specialist and leadership tasks in various economic fields.

In particular, the masters degree program QEM offers the students a comprehensive preparation, in accordance with international standards, for further academic qualification levels (PhD program in the field of business, economics and statistics), for example for future academic staff at universities or other research institutions.

**§ 2 Duration, scope and language of instruction**

(1) The total workload required for the masters degree program QEM is 120 ECTS. This corresponds to an expected duration of 4 semesters.<sup>1</sup>

(2) The language of instruction is English.

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<sup>1</sup> According to the current legal position, cf. the Austrian Universities Act (Universitätsgesetz, UG) 2002 § 54 par. 3.

### § 3 Prerequisites for admission

Admission to the masters program QEM requires a bachelors degree in a related discipline or a University of Applied Science bachelors degree in a related discipline or another equivalent degree from a recognized Austrian or foreign post-secondary educational institution.

The bachelors degree in Mathematics at the University of Vienna shall in any case be recognized as a degree in a related discipline. Equally, any degree program in which the material of the orientation period (*STEP*) as well as linear algebra, calculus and elementary probability theory are taught to an extent corresponding to the required modules a, b and h of the bachelors program in Mathematics at the University of Vienna (§5 (1) in the version valid on 21.6.2007) shall be deemed a degree in a related discipline.

If the degree is basically equivalent but certain, specific aspects are missing for full equivalence, additional courses and examinations comprising a maximum of 30 ECTS can be required for recognition of full equivalence; these can be completed during the masters program.

### § 4 Academic degree

Graduates of the masters degree QEM will be conferred the degree “*Master of Science*” – abbreviated as *MSc*. They are entitled to indicate these letters after their names.

### § 5 Structure - modules and module groups with designated ECTS

(1) Overview of the degree program:

The masters program QEM is divided into a core program and a specialization program, each comprising 50 ECTS. In order to successfully complete the program, a masters thesis must be written and presented in a masters seminar (*Konversatorium*). The joint workload for the masters thesis and the masters seminar comprises 20 ECTS.

(2) Core program: **50 ECTS**  
all of the following modules must be completed.

(C1) Economics	18 ECTS
(C2) Econometrics	8 ECTS
(C3) Optimization and Dynamical Systems	16 ECTS
(C4) Management Science	8 ECTS

(3) Specialization program: **50 ECTS**  
one of the following alternative required module groups must be completed.

(S1) Economics
(S2) Finance
(S3) Management
(S4) Operations Research

## § 6 Table of modules

(1)

	ECTS	SSt.
<b>Required module group for the core program</b>	<b>50</b>	
(C1) Economics	18	
UK Formal Modelling in Economics		2
UK Microeconomics		8
UK Macroeconomics or UK Game Theory		8
(C2) UK Econometrics	<b>8</b>	4
(C3) Optimization and Dynamical Systems	<b>16</b>	
UK Applied Optimization	4	2
UK Dynamical Economic Modelling	8	4
UK Graph Algorithms and Network Flows	4	2
(C4) UK Management Science	<b>8</b>	4
<b>Alternative required module group Economics</b>	<b>50</b>	
(E1) Theoretical Analysis UK Game Theory <i>or</i> UK Macroeconomics <i>(whichever was not selected under C1)</i>	8	4
(E2) UK Empirical Analysis	<b>8</b>	4
(E3) UK Advanced Econometrics	<b>8</b>	4
(E4) Elective module <i>Courses from the fields:     Economic Theory, Applied Economics or Finance     A seminar paper must be written in at least one course in this module.</i>	<b>26</b>	
<b>Alternative required module group Finance</b>	<b>50</b>	
(F1) Quantitative Methods	<b>10</b>	
UK Stochastic Processes	3	2
UK Financial and Insurance Mathematics	3	2
UK Financial Econometrics	4	4
(F2) Economics	<b>8</b>	
<i>If UK Macroeconomics was selected under C1     UK Game Theory     otherwise one of the following courses:     UK Macroeconomics     UK Industrial Economics     UK Financial Economics     UK Financial Markets</i>		
(F3) Finance	<b>16</b>	
EK Principles of Finance	8	4
Basics in Corporate Finance: EK Financial Policy <i>and</i> EK Creating Value	8	2+2
(F4) Elective module <i>Courses from the fields of banking, corporate finance, investments,     quantitative finance, financial econometrics     A seminar paper must be written in at least one course in this module.</i>	<b>16</b>	

<b>Alternative required module group Management</b>	<b>50</b>	
(M1) Marketing	<b>8</b>	
PR International Data Analysis <i>and</i> FK International Marketing Simulation <i>or</i> UK Market Research		2+2 4
(M2) Production/Logistics/Transport	<b>8</b>	
UK Production Analysis <i>or</i> UK Supply Chain Management <i>or</i> UK Transportation Logistics		4 4 4
(M3) Controlling, Accounting, Taxes UK Controlling UK Accounting and Taxes	<b>8</b>	4 2 2
(M4) Organization and Personnel UK Organizational Design UK <b>Advanced Personnel Economics</b>	<b>8</b>	4 2 2
(M5) Elective module <i>Courses from the modules offered in the specialization (Kernfachkombinationen, KFK) (§6(2) in the masters degree program Business Administration) A seminar paper must be written in at least one course in this module.</i>	<b>18</b>	
<b>Alternative required module group Operations Research</b>	<b>50</b>	
(O1) Operations Research and Computers	<b>8</b>	
SE Computational Operations Research	4	2
UK Software for Operations Research	4	2
(O2) Decision Support	<b>10</b>	
UK Methods of Decision Support	4	2
UK Stochastic Optimization	6	4
(O3) UK Production Management / UK Supply Chain Management / UK Transportation Logistics <i>(introductory module or elective module from one of the corresponding Kernfachkombinationen)</i>	<b>8</b>	4
(O4) UK Simulation <i>(same specialization as recommended in O3)</i>	<b>8</b>	4
(O5) UK LP/MIP <i>(same specialization as recommended in O3)</i>	<b>8</b>	4
(O6) UK Metaheuristics <i>(same specialisation as recommended in O3)</i>	<b>8</b>	4

(2) The responsible academic authority will determine and make public, in an appropriate fashion, the respective offer of courses currently available for the elective modules.

## § 7 Descriptions of modules

<b>(C1) Economics</b>
<p>Formal Modelling in Economics:</p> <p>Economic questions are analyzed with the help of simple formal models and recorded by the students in written essay form. Examples from various areas of economics will be drawn on (micro-economics, macro-economics, game theory, finance, etc.).</p> <p>Microeconomics:</p>

Theories about individual decisions and about the equilibria that thus arise under different information and competition-related conditions, as presented in internationally used texts books at advanced (postgraduate) level.

Macroeconomics:

Theories about economic growth and recession, as presented in internationally used textbooks on macroeconomics at advanced (postgraduate) level.

Game Theory:

Methodologies of game theory used in economics theory, in particular for games with incomplete information, as presented in internationally used textbooks on game theory within economic theory at advanced (postgraduate) level.

### **(C2) Econometrics**

Linear (multivariate) econometric models and selection of the appropriate procedures for given issues within the fields of business, economics and statistics.

### **(C3) Optimization and Dynamical Systems**

Applied Optimization:

convexity and duality in continuous optimization

Dynamical Economic Modelling:

dynamic systems in discrete and continuous time; dynamic programming and optimal control (finite/infinite time horizon)

Graph Algorithms and Network Flows:

modelling and optimization of discrete structures (graphs, flows, nets)

### **(C4) Management Science**

Fundamental problems and theoretical concepts from the fields of marketing, cost-accounting, financing, organization, personnel and production

### **(E1) Theoretical Analysis**

see (C1)

### **(E2) Empirical Analysis**

Application of the procedures presented in C2 to concrete economic data sets using suitable software

### **(E3) Advanced Econometrics**

Advanced models of theoretical econometrics and selection of appropriate procedures for given issues in the fields of business, economics and statistics (e.g. time series analysis, panel data, micro-econometrics)

#### **(E4) Elective module in Economics**

Closer study of sub-areas of theoretical economics, getting to grips with advanced theories and/or methods in order to examine these issues.

#### **(F1) Quantitative Methods**

Stochastic Processes:

Wiener process, Gaussian processes, martingales, stochastic differential equations

Financial and Insurance Mathematics:

models in continuous time, Brownian motion, geometric Brownian motion, financial processes as stochastic differential equations, Black-Scholes Option Pricing, newer models

Financial Econometrics :

trend, seasonal adjustment, non-parametric spectral analysis, auto-correlation, ARFIMA-processes, parametric spectral analysis, GARCH-processes

#### **(F2) Economics in the specialization program Finance**

Closer study of a sub-area of theoretical economics, which is closely associated with finance. (Cf. also C1 and E4.)

#### **(F3) Finance**

Principles of Finance:

evaluation of financial instruments (equity, bonds, derivatives)

Basics in Corporate Finance:

Financial Policy:

dividend policy, capital structure, risk management

Creating value:

introduction to value-oriented management, performance measurement for adding value to companies, value-oriented strategies, manager remuneration, supervisory board and managing board, corporate takeovers, shareholder activism

#### **(F4) Elective module in Finance**

Closer study of a sub-area of finance or of methodologies that are relevant for the analysis of financial issues.

#### **(M1) Marketing**

International Data Analysis + International Marketing Simulation:

tools and techniques for the analysis and interpretation of international marketing data; acquisition of practical skills to enable international marketing decisions on the basis of a simulation game.

Market research:

market research process, research designs, methodologies of market research, design of questionnaires, carrying out a survey, statistical analysis of the data

## **(M2) Production/Logistics/Transport**

### **Production Analysis:**

More detailed knowledge of problems, contents and methodologies of production: different production concepts (flow production, workshop production, ...), long- and short-term capacity planning, batch size and sequence planning

### **Supply Chain Management :**

More detailed knowledge of problems, contents and methodologies of SCMs: prognosis procedures, coordination, collaborative planning, contracts, procurement, supplier-customer relationships, distribution, location planning, capacity planning

### **Transportation Logistics:**

More detailed knowledge of problems, contents and methodologies of logistics (in particular transport and tour planning)

## **(M3) Controlling, Accounting, Taxes**

Fundamental concepts of external accounting taking into consideration tax issues as well as main managerial accounting and controlling instruments

## **(M4) Personnel, Organization**

Closer analysis of organizational design variables, in particular of coordination mechanisms and incentive systems and the distribution of decision-making powers. This creates a connection between theoretical analysis and the results of empirical organization research, which in particular also takes into account the effects of the limited rationality of the humans involved.

## **(M5) Elective Module in Management**

Closer study of sub-areas of business administration theory, in which quantitative methods are applied

## **(O1) Operations Research and Computers**

### **Computational Operations Research:**

computer-aided methods to solve tasks from operations research, for example metaheuristics, algorithms of mathematical programming, simulations procedures or computational procedures for multi-criteria decision analysis.

### **Software for Operations Research:**

applications training on the basis of case studies;  
concrete projects out of the field of operations research should be modelled and solved with the help of different software.

## **(O2) Decision Support**

### **Methods of Decision Support:**

operations research and artificial intelligence procedures to assist decision-making, in particular for the fields of networks, scheduling and project-planning. Comparisons and integration of various paradigms for decision support.

### **Stochastic Optimization:**

probability theory and reliability, lifetime distributions and hazard, stochastic decision-making models: warehousing, queuing theory, incl. stochastic programming.

### **(O3) Production Management / Supply Chain Management / Transportation Logistics**

see (M2)

### **(O4) Simulation**

Introduction to simulation, queuing theory, random numbers, experimental design, introduction to standard software

Specialization Production Management:

simulation of shop floors, implementation with the help of standard software

Specialization Supply Chain Management:

simulation of warehousing systems for spare parts and fresh produce, simulation of supply chains, design of simulation experiments, simulation optimization

Specialization Transportation Logistics:

simulation of stochastic transport problems, stochastic network flow problems, stochastic inventory routing problems

### **(O5) LP / MIP**

Introduction to linear programming (LP) and mixed integer programming (MIP), simplex algorithm & Excel Solver, duality and sensitivity theory, introduction to standard software

Specialization Production Management:

lot-sizing & scheduling, implementation with the help of standard software

Specialization Supply Chain Management:

linear and mixed integer optimization applications from the fields of location planning, choice of suppliers, capacity planning, decomposition and relaxation methods, stochastic programming

Specialization Transportation Logistics:

traveling salesperson problem, vehicle routing problem, extensions

### **(O6) Metaheuristics**

Introduction to diverse metaheuristics, Genetic Algorithms (GA), Ant Colony Optimization (ACO), Variable Neighborhood Search (VNS), Taboo Search

Specialization Production Management:

metaheuristics for scheduling and lot-sizing, application-oriented implementation

Specialization Supply Chain Management:

metaheuristics for supply chain management, application-oriented implementation

Specialization Transportation Logistics:

metaheuristics for tour planning and transport problems, application-oriented implementation

## **§ 8 Masters thesis**

- (1) The masters thesis should demonstrate the capacity to deal with academic topics independently and appropriately in terms of both content and methodology. The topic selected must be such as is possible and reasonable for the student to cover within six months.
- (2) The topic of the masters thesis must in principle derive from a module in the core or specialization program. If there is any ambiguity about the classification of the selected topic, the responsible academic authority shall decide thereupon.
- (3) The masters thesis shall be presented in a masters seminar for QEM students, insofar as possible in the presence of the respective supervisor. The students are awarded 2 ECTS for this presentation. The Conversatorium will be assessed as “pass” or “fail”.
- (4) The workload for the masters thesis is 18 ECTS.

## **§ 9 Classification of courses**

- (1) A module consists of one or more courses which are related in terms of subject-matter, and which together define a competence.
- (2) Courses are elements of the modules and will be offered either as lectures, university courses, internships or seminars.
- (3) In lectures (Vorlesungen, VO), knowledge is communicated primarily by the talks held by the course instructor. Lectures are courses without inherent examination character. Performance is assessed in each case by means of an examination.
- (4) University courses (Universitätskurse, UK) have inherent examination character. In order to emphasize the differing extent of specialization and contents on the one hand, and in order to be able to vary the involvement of the students in the knowledge transfer on the other, three different forms of university course are offered as options:
  1. Introductory university courses (Einführende Universitätskurse, EK):

Introductory university courses serve to introduce the student to the contents, methodologies and possible applications of a new area of expertise. Introductory university courses may not require any special prior knowledge in the subject and should convey to the students the significance of the subject in the context of their degree program.
  2. Continuing university courses (Fortführende Universitätskurse, FK):

Continuing university courses allow the student to specialise in a particular subject field. Continuing university courses can usually only be taken if the student has completed the corresponding introductory university courses and has also completed any module required in the curriculum as a prerequisite.
  3. Advanced university courses (Vertiefende Universitätskurse, VK):

Advanced university courses allow the student to acquire and consolidate methodological and content-related skills in a subject field, which are of particular significance for problem-solving when it comes to practical issues. Advanced university courses build on the contents of either introductory or continuing university courses and should only be taken by the student after such have been completed. In certain cases it is possible to attend both during the same semester. In advanced university courses student participation should be strong and group and team work should be promoted.

(5) Seminars (Seminare, SE) are courses based on academic discussion. Independent oral and written contribution is required of the participants, in the context of which the students should work on a topic independently and then present their results to the group. There is a special focus on learning how to carry out literature research autonomously and develop an attractive oral presentation style.

(6) Practical courses (Praktika, PR) are courses involving primary applications of the contents of the program, in which the students must tackle relevant problem constellations independently.

(7) In the masters program QEM, 30 places are available for practical courses and university courses and 24 places for seminars and internships.

(8) The students must follow the procedure described in the annex in order to register for courses.

## **§ 10 Examination rules**

(1) The course instructor shall reveal the structure and design of the course as well as the recommended prior knowledge before such course begins. In courses with inherent examination character, assessment of performance is based on the participation of the students during the entire duration of the course as well as assessment criteria which are stated at the beginning by the course instructors. Written or oral course examinations for lectures (courses without inherent examination character) shall be held after the end of such course.

(2) With the exception of the masters seminar for QEM students, course examinations and the masters thesis are assessed on a scale of 1 – 5 (very good, good, satisfactory, adequate, inadequate).

(3) The examination in a module has been passed when the student submits transcripts of results showing that s/he has passed all of the courses in such module. If a module consists of several courses, the overall assessment for the module is derived from the arithmetic average of the individual course assessments weighted according to the ECTS per course. The respective courses can be repeated independently of each other.

(4) If this average is not a whole number, the corresponding module mark is rounded up to the next whole number if the difference between the weighted average and the next smaller whole number is bigger than 0.5. If the difference is less than or the same as 0.5 then the relevant module mark is to be rounded down to the next whole number.

(5) The entire program is deemed to have been successfully completed when the student has passed examinations for all of the modules listed in the table of modules (see § 6) and the masters thesis has been approved. In this case the overall mark will be “passed” or “passed with distinction”. The program is passed with distinction if no module received a mark worse than “good” and at least half of the modules have been marked as “very good” and the masters thesis has been marked “very good”.

## **§ 11 Entry into force**

This curriculum enters into force after its promulgation in the University Gazette of the University of Vienna, on 1 October 2009.

# Registration Procedure

## Allocation of course places

### Fundamental principles of the system

The registration system is based on a supply-demand model with an auction-type mechanism. The supply is represented by the number of course places available (per course), demand by the registration of students. Demand is realised in that every student indicates a bid in a number of points determinable individually by her/him for the course places desired. S/he has a limited budget of points available for this purpose. The auction-like aspect is that in the event of demand exceeding supply, the course places will be allocated to the students who placed the highest bids.

### Mode of registration

- Each student receives a number of points per semester, whereby this budget of points can change from semester to semester. The rules which determine how many points each student gets can take a series of factors into account, e.g. academic achievement thus far. The applicable rules are set by the study program director and the up-to-date version is published on the website of the Faculty for Business, Economics and Statistics.
- In a second step, each student can allocate the points in this budget to the courses which s/he wants to attend in the relevant semester. The student has a free hand in the allocation of her/his points, subject to one exception, and can express individual preferences in the amount of points allocated. The exception concerns additional points, which are granted when the student did not receive a place in a particular course in the previous semester. In such case, the study program director may allocate the points bid for this course in the previous semester additionally, but stipulate that these additional points can only be used for this particular course.
- After the last registration day, the course places are allocated according to the following algorithm:
  - The study program director can set up quotas in individual courses, which quotas are reserved for certain groups of students or for which such students will be given priority.
  - In the case of courses for which the supply of places (as applicable per quote) is greater than demand (as applicable per quota), all students who applied for places will be admitted.
  - In the case of courses for which the supply of course places (as applicable per quota) is smaller than the demand, the course places will be allocated to the students with the highest point bids until the maximum number of course participants has been reached.
- In cases in which the course places are not all allocated, a late registration option will be offered. A late registration is also possible for such students as were unable to register during the normal registration times.
- If demand exceeds the supply of course places, a waiting list will be drawn up corresponding to the points bid by students for the planning of future allocation. On the basis of such waiting lists and taking the teaching budget available into account, additional courses may be suggested by the study program director.
- It will be announced in an appropriate manner which students have finally been admitted to which course.

