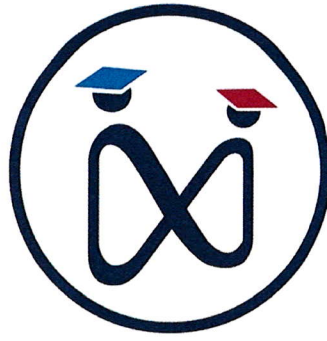




UNIVERSITÀ  
DEGLI STUDI  
DELL'AQUILA



**REALMATHS CONSORTIUM**  
INTERNATIONAL DOUBLE MSc DEGREE  
PROGRAMME IN  
*MATHEMATICS FOR REAL WORLD  
APPLICATIONS*



**RealMaths**

**Implementation Agreement**

**between**

***Università degli Studi dell'Aquila***

**University of L'Aquila**

(Hereinafter also referred to as “UAQ”)

*Palazzo Camponeschi, Piazza Santa Margherita 2, 67100 L'Aquila, Italy,  
Represented by its Vice Rector for International Affairs, Prof. Bruno Rubino,*

**and**

**Київський національний університет імені Тараса Шевченка**

**Taras Shevchenko National University of Kyiv (Ukraine)**

(Hereinafter also referred to as “TSNUK”)

*Volodymyrska St, 60, Kyiv, Ukraine, 01033*

*Represented by its Vice Rector for Education (International Cooperation),*

*Prof. Kseniia Smyrnova*

**2023 edition**

## **Preamble**

Having regard to Article 8 of the Consortium Agreement for the International Double MSc Degree Programme in Mathematics for Real World Applications (*RealMaths*) established on 17.03.2022, the undersigning universities hereby agree on the following points.

### **Article 1 – Purpose of the Agreement**

The purpose of this bilateral Implementing Agreement is to define the modalities of collaboration between the partners as of the 2023 cohort for the implementation of a Double Degree programme in *RealMaths*.

### **Article 2 – Legal framework and national qualifications**

2.1 The study programme, which is the object of the present Agreement, is implemented in observance of the national laws and regulations in force in the respective partner institution's countries.

2.2 The local graduate programmes run at each partner institution, on which our International double degree programme relies, have both been subject to national accreditation. The executive decision of accreditation or equivalent documents are available upon request.

2.3 Such local graduate programmes grant access to doctoral programmes.

2.4 Both partner institutions are authorized to award double degrees in the framework of an International double degree programme.

### **Article 3 – Limits of admitted students and *Partner Students*' selection**

3.1. The objective is to allow students from TSNUK to enrol in the International Joint Master's Programme. The two local coordinators can select a maximum of 15 *Partner Students* per cohort for both branches. In order to promote this Programme the Partners can decide to open the Programme for a smaller number of students.

3.2. This provision may be modified, subject to the agreement between parties.

This process must be completed by the mid of November of the cohort year if the student is going to spend the second semester of the first year and the first semester of the second year (third semester) in the Partner institution.

3.3. Applicants wishing to participate in the Programme need to have obtained a first cycle degree (Bachelor). The applicants must have very good knowledge and skills of English. The selection and admission process requires submission of the following materials:

- a) Transcript of records related to undergraduate studies.
- b) Bachelor's degree certificate.

- c) Curriculum vitae.
- d) Intent letter.
- e) Two reference letters.

Proof of English language proficiency.

3.4. The applicants shall apply for the Master's Programme (for the first branch in *Applied Mathematics*, for the second branch in *Systems and Methods of Decision Making*) at Taras Shevchenko National University of Kyiv according to its admission regulations. Taras Shevchenko National University of Kyiv will select, among their students from the Master's Programme in *Applied Mathematics* (for the first branch) or in *Systems and Methods of Decision Making* (for the second branch) highly motivated candidates for the International Joint Master's Programme. Afterwards, the Local Coordinators from TSNUK will evaluate the submitted applications and compile a ranked list of eligible students based on the average score of their bachelor diploma, level of English language proficiency, and motivation. The list of selected candidates is then submitted to the other partner institution, who may require to interview the candidates before validating the list and finalising their admission. Eligible students will be notified by TSNUK and will have 15 days to accept the position offered.

3.5. Taras Shevchenko National University of Kyiv shall be responsible for notification about admission results. Admitted students shall be responsible for filling and uploading the documents, including certified copies of the first cycle degree diplomas.

#### **Article 4 – Programme Organization**

4.1 Partner students selected by TSNUK shall complete the first & forth semester of their double degree programme at TSNUK and second & third semester at UAQ.

4.2 The responsibility for management and administration of the Programme shall rest with both of the Partners if not otherwise stipulated.

4.3 The Partners shall decide on the content of the Programme, students' selection criteria and admission procedure, the organization and quality assurance of studies and other related questions within the range of their competence. These decisions will be subject to the final approval by the relevant authorities of each Partner.

4.4 For the practical administration of the Programme, the Partners are entitled to set up a Programme's Committee formed on the basis of equal representation of the Partners and include a student representative. Registered students of the Programme elect their representative to be part of the Programme's Committee. The Programme's Committee will have the responsibility concerning all major internal proposals for decisions to be undertaken with the respect to the Programme, including changes in the Programme's study plan and Curriculum and this Agreement. These decisions will be

subject to the final approval by the relevant authorities of each Partner. The Programme of study is approved by the Partners, according to the rules and procedures in force in each Institution.

4.5 Consultation of the Students concerning the general procedure of studies shall be provided by staff members of the Institutions, responsible for practical implementation of the Programme. Consultation of the Students concerning the academic content shall be provided by the teachers responsible for practical implementation of the Programme individually during their consultations.

Consultation of the Students concerning opportunities of the professional career or internships shall be provided by the specialized offices of both Institutions. Administrative, social and other matters (such as visa, accommodation, loans, special needs support, etc.) of Students are taken care by the Units, responsible for practical implementation of the Programme, or specialized offices of both Institutions.

Each of the two universities recognizes the study and examination rules of the partner university. Both parties recognize the results obtained in the Partner university.

4.6 Language of instructions of the Programme shall be English. Lectures, seminars, tutorials etc. shall be carried out in English. Examinations shall be carried out in English unless the Programme's committee decides otherwise. Master thesis defence shall be drawn up in English. Master thesis defence shall be conducted in English.

4.7 In the event of circumstances that make it impossible to provide educational services to students face-to-face, the partners agree on the issue of conducting educational classes using information and communication technologies, according to the rules and procedures in force in each Institution.

#### **Article 5 – Degree titles awarded by each signatory partner**

After completion of the 2-year double degree Programme and the corresponding degree requirements of the programme, the student is awarded a degree parchment by each of the two Institutions:

I. The first branch:

- UAQ: MSc in Mathematical Engineering.
- TSNUK: MSc in Applied Mathematics

II. The second Branch:

- UAQ: MSc in Mathematical Engineering.
- TSNUK: MSc in System Analysis

Both Institutions also issue a transcript of records and a diploma supplement to the student.

## **Article 6 – Student Registration and Fees**

6.1 Students participating in the *RealMaths* programme will be enrolled simultaneously in both institutions.

6.2 The respective registration services of the Partner universities harmonize their registration procedures as much as possible to facilitate the administrative procedures of the students concerned.

6.3 Students participating in the *RealMaths* programme will pay registration and tuition fees (and any other fees) to their home institution exclusively. Any other fee that might be required for the enrolment and registration at the Hosting Institution, being a party to this Agreement, will be covered by this Institution, local authorities, public bodies and private corporations available at the Hosting Institution.

6.4 Students will be required to pay for any other personal expenses during their exchange period (including travelling, lodging and food expenses), unless otherwise specified.

6.5 Students participating in the *RealMaths* programme are required to obtain (prior to beginning of their mobility period) a private health insurance covering personal accident insurance and illness insurance due to pandemic situation, civil liability insurance during travelling and studying.

## **Article 7 – Rights and obligations of partner institutions and the students**

In addition to the obligations of each partner institution towards the Consortium (in particular with regard to collaboration in the selection of Consortium students), the obligations of the sending and receiving institutions are set out below.

### **a) Obligations of each partner institution vis-à-vis the students who will participate in this joint programme (home institution):**

- Recruit, select and prepare Partner students who will participate in the Programme.
- Ensure that the selected students meet the admission criteria (see art. 3).
- Forward the applications of the selected students according to the instructions given by the host university.
- Register their own students at their university throughout the study program.
- Ensure that students purchase the compulsory insurance (see art. 8).

### **b) Obligations of each partner vis-à-vis the students they will receive as part of this programme of study (receiving institution):**

- Exempt students from registration and tuition fees.

- Welcome and guide students in the study programme.
- Facilitate and provide information on housing options for students.
- Provide academic supports and educational advice to participating students.
- Provide all other relevant supports and assistance.
- Transmit the statement of the results of the participating students to the local coordinator of the partner institution.

**c) Obligations of students participating in the program of studies:**

- Fulfil the academic obligations under the Double Degree programme.
- Obtain, where appropriate, an adequate visa from the embassy of the host country.
- Pay registration and tuition fees at their home university (*Partner students* only) in time.
- Respect the rules and regulations in force at the host university.
- Pay the expenses during their stay (food, accommodation, and other personal expenses).
- Purchase compulsory insurance, pay for medical expenses and prove liability insurance.

**Article 8 – Programme and student supports**

The Partners endeavour, whenever possible, to provide support for student mobility through national and/or European grants.

At TSNUK and UAQ, students have access to all services available to students including, but not limited to, academic advising, counselling and disability services, and access to academic and recreational facilities.

**Article 9 – Special measures to enhance the degree of integration**

The faculties and professors in charge of the double-degree programme at both institutions are committed to promoting the exchange and mobility of teaching and administrative staff.

**Article 10 – Quality assurance and further development of the Programme**

10.1 Each Partner follows its own national and institutional quality assurance procedures to ensure that the Programme maintains its high academic standards.

10.2 All teaching staff of the Programme shall have necessary qualifications assuring the quality of teaching within the Programme, including English language proficiency.

10.3 In addition, all courses of the Programme shall be evaluated by the students. The outcomes of the evaluations shall be used as an input in the annual Programme Curriculum assessment by the Programme Committee.

10.4 External quality assurance shall be guaranteed by arranging frequent (at least annual) overall Programme's evaluation involving stakeholders from outside the Programme (e.g. labour market representatives or external experts) under the responsibility of the Programme Committee. Monitoring of alumni career and employability together with the analysis of alumni evaluations could be used for the improvement of the Programme Curriculum.

### **Article 11 – Intellectual property rights and confidentiality**

11.1 Establishment of the intellectual property rights relating to academic content would remain with the Partner responsible for the implementation of the relevant part of the Programme. The Partner responsible for the delivery of a course shall be responsible for obtaining the necessary third party authorization if necessary.

11.2 Each Partner agrees to keep as confidential any information, data, know-how, document or other material which is communicated to as confidential, or the disclosure of which may be clearly prejudicial to other Partner in accordance with relevant national and international legislation.

### **Article 12 – Dispute Settlement**

12.1 Agreement and its appendixes are drawn up in two original copies in Ukrainian, Italian and English languages each, one original copy to each Partner. In all cases the English language version shall prevail.

12.2 In case of a dispute between the Partners, both Partners shall first endeavour to settle it amicably. Where an amicable solution is not reached, the dispute shall be submitted to the court of the state of the Partner in which the dispute has arisen.

### **Article 13 – Validity and duration of the Agreement**

13.1 Two original copies are signed by each partner university, both texts being equally authentic.

13.2 This bilateral Implementing Agreement shall apply to the 2023 cohort subject to the authorization or accreditation of the master's degrees issued during the period concerned and will be extended to the following cohort unless the local coordinators

propose a revision by April 2024.

13.3 Each university may, at any time, request the modification or termination of this Agreement, subject to informing the other partner in writing of its decision, with six months' notice. To be valid, such changes must be approved by both partners through endorsement.

Should this agreement be terminated, the universities will have to guarantee that the students who, at the time of termination, are already engaged in their studies under the Agreement, can complete them, according to the aforementioned rules.

13.4 For conditions not covered by the present Agreement, or for problems that arise during the course of the Agreement, both Parties agree to refrain from unilateral action and to consult and negotiate mutually acceptable decisions.

13.5 This Agreement may be executed in counterparts, each of which will constitute an original, and all of which together will constitute a single agreement.

#### Article 11 – Annexes

This Agreement contains two annexes:

Appendix A: Program of Studies

Appendix B: Credit transfer policy between the two signatory partners

**For the University of L'Aquila**

**For Taras Shevchenko National  
University of Kyiv:**

  
\_\_\_\_\_  
**Prof. Bruno RUBINO**

Vice Rector for International Affairs

  
\_\_\_\_\_  
**Prof. Kseniia SMYRNOVA**

Vice-Rector for Education (International  
Cooperation)

Date: \_\_\_\_\_

Date: August 1<sup>st</sup>, 2023

## Appendix A: Program of Studies

*RealMaths* is designed for completion in two academic years of full-time study.

*RealMaths* requires students to achieve at least 120 credits to gain their final qualification.

Students will spend their first year of study at UAQ and their second year of study at TSNUK, earning at least 60 ECTS credits in each Institution.

An overview of how each academic year is structured is provided below.

### First branch - Applied Mathematics

#### First year

##### First semester (Taras Shevchenko National University of Kyiv)

MODULE NAME	ECTS Credits	Sem.
Dynamic Systems Simulation (3,0 ECTS)	3	I
Project Management (3,0 ECTS)	3	
Advanced Topics in Functional Analysis Module1. Applied functional analysis (3,0 ECTS) Module 2. Convex and nonlinear analysis (3,0 ECTS)	6	I
Theory of Optimization in Functional Spaces (3,0 ECTS)	3	I
Advanced Topics in Applied Mathematics (3,0 ECTS)	3	
Problems of Non-Classical Optimization (6,0 ECTS)	6	I
Methodology and organization of scientific research and intellectual property basics (3,0 ECTS)	3	I
Information Networks (3,0 ECTS)	3	I
<b>Total</b>	<b>30</b>	

##### Second semester (University of L'Aquila)

MODULE NAME	ECTS Credits	Sem.
<b>Discrete and continuum mechanics with applications</b>	6	II
<b>Kinetic theory and stochastic simulations</b>	6	II
<b>Numerical convex optimisation</b>	6	II
<b>Big data models and algorithms</b>	6	II
<b>ICT security</b>	6	II
<b>Total</b>	<b>30</b>	

## Second year

### Third semester (University of L'Aquila)

<b>MODULE NAME</b>	<b>ECTS credits</b>	<b>Sem.</b>
<b>Dynamical systems and bifurcation theory</b>	7	III
<b>Real and functional analysis</b>	6	III
<b>Machine learning for automation</b>	6	III
<b>Artificial intelligence and machine learning for natural hazards risk assessment</b>	6	III
<b>Mathematical modelling and HPC simulation of natural disasters</b>	6	III
<b>Total</b>	<b>31</b>	

### Fourth semester (Taras Shevchenko National University of Kyiv)

<b>MODULE NAME</b>	<b>ECTS credits</b>	<b>Sem.</b>
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Module 1. Mathematical Models of Cybernetics (9.0 ECTS). Module 2. Modern Problems of Applied Mathematics (3,0 ECTS)</li><li>- Module 1. Technologies of Information Processing (9.0 ECTS). Module 2. Adaptive Information Processing and Recognition (3,0 ECTS)</li><li>- Module 1. Non-classical Problems of Optimal Control (9,0 ECTS). Module 2. Non-classical Problems of Mathematical Physics (3,0 ECTS)</li></ul>	12	IV
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Mathematical Risk Theory (3,0 ECTS).</li><li>- Applied Problems of Risk Theory (3,0 ECTS)</li><li>- Risk Management and Decision Making (3,0 ECTS)</li></ul>	3	IV
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Artificial Intelligence Methods (3,0 ECTS)</li><li>- Advanced Topics of Artificial Intelligence (3,0 ECTS)</li><li>- Imitation Methods of Information Flows Simulation in Computer Networks (3,0 ECTS)</li></ul>	3	IV
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Information Technologies (3,0 ECTS)</li><li>- Technologies of Information Processing and Analysis (3,0 ECTS)</li><li>- Internet security and anonymity (3,0 ECTS)</li></ul>	3	IV

Industrial Practice	3	IV
Master's Thesis	5	IV
<b>Total</b>	<b>29</b>	

**Second branch - Systems and Methods of Decision Making**

**First year**

**First semester (Taras Shevchenko National University of Kyiv)**

<b>MODULE NAME</b>	<b>ECTS Credits</b>	<b>Sem.</b>
Mathematical models of insurance and pension schemes	3	I
Foreign language for academic purposes	3	I
Statistical theory of decision making (3,0 ECTS)	3	I
Pedagogy and psychology of high school	3	I
Methodology and organization of scientific research and intellectual property basics	3	I
Bayesian networks	4	I
Theory of extremal problems	4	I
Modern programming technologies	6	I
<b>Total</b>	<b>29</b>	

**Second semester (University of L'Aquila)**

<b>MODULE NAME</b>	<b>ECTS Credits</b>	<b>Sem.</b>
<b>Numerical convex optimisation</b>	6	II
<b>Network algorithms</b>	6	II
<b>Decision optimisation</b>	7	II
<b>Deep neural networks</b>	6	II
<i>A choice between (UAQ):</i> <ul style="list-style-type: none"> <li>- Artificial intelligence for medical imaging</li> <li>- Combinatorics and cryptography</li> <li>- Kinetic theory and stochastic simulations</li> </ul>	6	II
<b>Total</b>	<b>31</b>	

## Second year

### Third semester (University of L'Aquila)

MODULE NAME	ECTS credits	Sem.
<b>Systems modelling and simulation</b>	6	III
<i>A choice between (UAQ):</i> <ul style="list-style-type: none"><li>- <b>Optimal control,</b></li><li>- <b>Systems identification and data analysis</b></li></ul>	9	III
<b>Modelling and control of networked distributed systems</b>	6	III
<i>A choice between (UAQ):</i> <ul style="list-style-type: none"><li>- <b>Non-cooperative networks,</b></li><li>- <b>Social networks</b></li></ul>	3	III
<b>Process and operations scheduling</b>	6	III
<b>Total</b>	<b>30</b>	

### Fourth semester (Taras Shevchenko National University of Kyiv)

MODULE NAME	ECTS credits	Sem.
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Information and analytical systems (4,0 ECTS)</li><li>- IT project management (4,0 ECTS)</li><li>- Selective sections of system optimization (4,0 ECTS)</li></ul>	4	IV
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Modern problems of systems analysis (6,0 ECTS).</li><li>- Applied methods of analysis and modeling of processes with nonlinear dynamics (6,0 ECTS)</li><li>- Control and signal processing (6,0 ECTS)</li></ul>	6	IV
<i>A choice between:</i> <ul style="list-style-type: none"><li>- Data intelligent analysis (4,0 ECTS)</li><li>- Time series: analysis and forecast (4,0 ECTS)</li><li>- Classification algorithm (4,0 ECTS)</li></ul>	4	IV
<b>Methods of teaching mathematics and computer science in the high school (3,0 ECTS)</b>	3	IV
<b>Risk Analysis and Optimization (3,0 ECTS)</b>	3	IV
<b>Industrial Practice (4,0 ECTS)</b>	4	IV
<b>Pedagogic practice (3,0 ECTS)</b>	3	IV
<b>Master's Thesis (3,0 ECTS)</b>	3	IV
<b>Total</b>	<b>30</b>	

Individual study plans may also be taken into account, if appropriately motivated, but they will have to be approved by the Management Board.

## **Extra conditions**

### **a) Extra conditions from UAQ side**

To fulfil the regularisation norms from UAQ side, students must reach A2 level of Italian language during the academic year in UAQ. UAQ offers the courses of *Italian language for foreigners* which will allow non-native students to understand and use basic local language in the most common situations of their university life. Upon successful completion of a before mentioned courses, *RealMaths* students will be awarded 6 ECTS credits, which will be acknowledged as extra credits in the student's curriculum.

### **b) Extra conditions from TSNUK side**

#### *First branch*

To fulfil the regularisation norms from TSNUK side, students must gain additional credits in the following courses and activities (or their equivalents in the partner institution):

- Industrial Practice (3,0 ECTS), third semester,
- Industrial Practice (3,0 ECTS), fourth semester.

To fulfil the regularisation norms from TSNUK side, students must pass the Comprehensive Exam in Applied Mathematics in the end of the second academic year in TSNUK.

#### *Second branch*

To fulfil the regularisation norms from TSNUK side, students must gain additional credits in the following courses and activities (or their equivalents in the partner institution):

- Term Paper (4,0 ECTS), second semester,
- Master's Thesis (5,0 ECTS), third semester.

To fulfil the regularisation norms from TSNUK side, students must pass the Comprehensive Exam in *Systems and Methods of Decision Making* in the end of the second academic year in TSNUK.

## Master's thesis and thesis defence

In addition to examinations, at the end of the joint Master Programme, each student will prepare a Master's thesis. A professor or researcher from the host University, as far as possible in close collaboration with the thesis supervisor from the University of origin, will tutor the thesis.

The thesis will be drawn up and delivered in English according to the rules provided by the University where the training takes place.

The thesis discussion will take place only once in the University where the student spends the last semester, in the presence of both members or by videoconference. However, at the request of the student approved by both local coordinators, the discussion of the thesis can take place twice, once for each of the two institutions. The final manuscript as well as the data and the associated results will be subjected to the rules of confidentiality of the University where the training takes place.

## Appendix B: Credit transfer policy between the two signatory partners

Student's performance is documented through the national grading system in force at each partner institution.

The transfer of records from the institution, where the student is actually studying, should be done once upon completion the study year, but not later than August 30<sup>th</sup>.

The transfer and recognition of grades from one institution to the other will be based on the scales below:

Grades gained at UAQ					
UAQ	TSNUK	UAQ	TSNUK	UAQ	TSNUK
30 e lode	100	23	75	OTTIMO	90
30	97	22	73	DISTINTO	85
29	94	21	70	BUONO	75
28	90	20	67	DISCRETO	65
27	88	19	64	SUFFICIENTE	60
26	85	18	60	INSUFFICIENTE	<60
25	81	<18	<60		
24	78				

Grades gained at TSNUK					
TSNUK	UAQ	TSNUK	UAQ	TSNUK	UAQ
99-100	30 e lode	85-87	26	70-72	21
97-98	30	81-84	25	67-69	20
94-96	29	78-80	24	64-66	19
90-93	28	74-77	23	60-63	18
88-89	27	73-74	22	<60	<18

Moreover, if necessary, grades gained at TSNUK can be transferred in UAQ as follows:

Grades gained at TSNUK		
TSNUK		UAQ
90-100	EXCELLENT	OTTIMO
85-89 75-84	GOOD	DISTINTO BUONO
65-74 60-64	SATISFACTORY	DISCRETO SUFFICIENTE
1-59	UNSATISFACTORY	INSUFFICIENTE