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 Prof. Bruno Rubino, Vice Rector for International Affairs

and

Харківський національний університет імені В. Н. Каразіна

V.N. Karazin Kharkiv National University (Ukraine)

(Hereinafter also referred to as "KhNU")

4 Svobody Sq., Kharkiv, 61022, Ukraine

Represented by Prof. Zarif Nazyrov, Vice Rector for International Relations

2024 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 in April 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 2024 cohort for the implementation of a Double Degree programme in *RealMaths*.

Article 2 – Legal framework and national qualifications

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.

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.

Such local graduate programmes grant access to doctoral programmes.

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

The Parties will exchange students on a reciprocal basis. The two local coordinators can select a maximum of 15 *Partner Students* per cohort.

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

Each partner institution, by means of an internal commission, selects their own candidates who are highly motivated for joining the Double Degree Programme. 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.

This process must be completed:

- By the mid of August of the cohort year if the student is going to spend the first year in the partner institution.
- By the mid of December of the cohort year if the student is going to spend the second year in the partner institution.

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.
f) Proof of English language proficiency.

Article 4 – Programme Organization

Partner Students selected by UAQ shall complete the first year of their double degree programme at UAQ.

Partner students selected by KhNU can choose between two options:

- First & fourth semester at UAQ and second & third semester at KhNU;
- First year at UAQ and second year at KhNU.

The programme of study is approved by the partner universities, according to the rules and procedures in force in each institution.

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.

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:

- UAQ:
  - MSc in ***Mathematics*** for the branch "Mathematics"
  - MSc in ***Mathematical Engineering*** for the branch "Applied Mathematics".
- KhNU:
  - MSc in ***Mathematics*** for the branch "Mathematics"
  - MSc in ***Applied Mathematics*** for the branch "Applied Mathematics".

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

Article 6 – Student Registration and Fees

The students of the programme enrol simultaneously at both universities.

Students register according to the rules in place at each of the partner universities.

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.

Partner Students shall pay registration and tuition fees at their home university exclusively.

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. 4).
- 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 KhNU 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 – Validity and duration of the Agreement

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

This bilateral Implementing Agreement shall apply to the 2024 cohort subject to the authorization or accreditation of the master's degrees issued during the period concerned.

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.

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.

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: Rating Conversion Scale

For the University of L'Aquila

Prof. Bruno Rubino
Vice Rector for International Affairs

Date: **12 September 2024**

For V.N. Karazin Kharkiv National University

Prof. Zarif Nazyrov
Vice Rector for International Relations

Date:

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 two semesters of study at UAQ and two semesters of study at KhNU, earning at least 60 ECTS credits in each Institution.

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

a) Branch "Mathematics" – Study plan 1

First semester – UAQ

MODULE NAME	Semester	ECTS Credits
Advanced Analysis	1	9
Advanced Geometry	1	9
Mathematical Models for Collective Behaviour	1	6
Time Series and Prediction	1	6
Total		**30**

Second semester – KhNU

MODULE NAME	Semester	ECTS Credits
Modern optimal control theory	2	6
Complex analysis II	2	7
Research course work	2	3
Select 2 courses: • Selected Topics of Complex Analysis and Operators Theory • Theory of Banach Spaces • Modern Harmonic Analysis • Partial Differential Equations II	2	14
Total		**30**

Third semester – KhNU

MODULE NAME	Semester	ECTS Credits
Select 3 courses: • Selected Topics of Number Theory • Geometry of Lie Groups • Topological Vector Spaces • Nonlinear Equations of Mathematical Physics • Selected Topics of Riemann Geometry	3	18
Undergraduate practice (without separation from classes)	3	9
Preparation and defense of the thesis	3	3
Total		**30**

Forth semester – UAQ

MODULE NAME	Semester	ECTS Credits
Kinetic Theory And Stochastic Simulations	4	6
Numerical Methods for Differential Equations	4	6
Large Complex System	4	6
Master's Thesis	4	12
Total		**30**

b) Branch "Mathematics" - Study plan 2

First semester – UAQ

MODULE NAME	Semester	ECTS Credits
Advanced Analysis	1	9
Advanced Geometry	1	9
Mathematical Models for Collective Behaviour	1	6
Time Series and Prediction	1	6
Total		**30**

Second semester – UAQ

MODULE NAME	Semester	ECTS Credits
Advanced Algebra	2	9
Advanced Probability	2	9
Numerical Methods for Differential Equations	2	6
Algebra for Cryptanalysis	2	6
Total		**30**

Third semester – KhNU

MODULE NAME	Semester	ECTS Credits
Select 3 courses: • Selected Topics of Number Theory • Geometry of Lie Groups • Topological Vector Spaces • Nonlinear Equations of Mathematical Physics • Selected Topics of Riemann Geometry	3	21
Research course work	3	3
Master seminar	3	6
Total		**30**

Forth semester – KhNU

MODULE NAME	Semester	ECTS Credits
Select 3 courses: • Introduction to Inverse Problems of Spectral Analysis • Banach Algebras and Spectral Theory • Almost periodic Functions • Basics of Representation Theory	4	12
Master seminar	4	6
Undergraduate practice (without separation from classes)	4	7
Preparation and defense of the thesis	4	5
Total		**30**

c) Branch "Applied Mathematics" - Study plan 1

First semester – UAQ

MODULE NAME	Semester	ECTS Credits
Real and functional analysis	1	6
Dynamical systems and bifurcation theory	1	6
Control systems	1	6
Introduction to mathematical control theory	1	3
Elective course(s)	1	6
Italian language for foreigners (level A1)	1	3
Total		**30**

Second semester – KhNU

MODULE NAME	Semester	ECTS Credits
Modern optimal control theory	2	6
Fourier transform and its application	2	6
Master seminar	2	3
Select 2 courses: • Problems of Applied Mathematics and Modern Technologies • Computer Graphics and Algorithms of Image Processing • Deep Machine Learning • Analytics for Business and Science		12
Research course work	2	3
Total		**30**

Third semester – KhNU

MODULE NAME	Semester	ECTS Credits
Elective course(s)	3	12
Master seminar	3	3
Industrial practice (without separation from classes)	3	5
Undergraduate practice (without separation from classes)	3	5
Preparation and defense of the thesis	3	5
Attestation Exam	3	
Total		**30**

Forth semester – UAQ

MODULE NAME	Semester	ECTS Credits
Kinetic theory and stochastic simulations	4	6
Combinatorics and cryptography	4	6
Elective course(s)	4	12
Master's Thesis	4	6
Total		**30**

d) Branch "Applied Mathematics" - Study plan 2

First semester – UAQ

MODULE NAME	Semester	ECTS Credits
Advanced Analysis	1	6
Mathematical Models for Collective Behaviour	1	6
Machine Learning for Automation	1	6
Artificial Intelligence and Machine Learning for Natural Hazards Risk Assessment	1	6
Mathematical Modelling and HPC Simulation of Natural Disasters	1	6
Total		**30**

Second semester – UAQ

MODULE NAME	Semester	ECTS Credits
Data analytics and data driven decision	2	9
Big data models and algorithms	2	6
Parallel computing	2	3
ICT security	2	6
Seismology	2	6
Total		**30**

Third semester – KhNU

MODULE NAME	Semester	ECTS Credits
Elective course 1	3	6
Elective course 2	3	6
Mathematical Modelling of Dynamical Systems in Biology, Ecology and Medicine	3	6
Master seminar	3	3
Research Course Work	3	3
Research practice (without separation from classes)	3	6
Total		**30**

Forth semester – KhNU

MODULE NAME	Semester	ECTS Credits
Elective course 3	4	6
Master seminar	4	6
Research practice (without separation from classes)	4	6
Undergraduate practice (without separation from classes)	4	6
Preparation and defense of the thesis	4	6
Attestation Exam	4	--
Total		**30**

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

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.

Master's thesis and thesis defence

The thesis discussion will take place only once in the University where the student spends the second year, 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.

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

Grades gained at UAQ						
UAQ	**KhNU**	**UAQ**	**KhNU**	**UAQ**	**KhNU**	
30 e lode	100	23	70	OTTIMO	95	EXCELLENT
30	98	22	66	DISTINTO	85	GOOD
29	95	21	61	BUONO	75	
28	90	20	60			
27	88	19	56	DISCRETO	65	SATISFACTORY
26	83	18	50	SUFFICIENTE	55	
25	78	<18	<50	INSUFFICIENTE	<50	UNSATISFACTORY
24	73					

Grades gained at KhNU					
KhNU	**UAQ**	**KhNU**	**UAQ**	**KhNU**	**UAQ**
99-100	30 e lode	81-84	26	61-63	21
97-98	30	75-80	25	58-60	20
94-96	29	71-74	24	54-57	19
90-93	28	68-70	23	50-53	18
85-89	27	64-67	22	<50	<18

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

Grades gained at LPNU	
KhNU	**UAQ**
90-100	OTTIMO
80-89	DISTINTO
70-79	BUONO
60-69	DISCRETO
50-59	SUFFICIENTE
< 50	INSUFFICIENTE