

2021 WAMS School Project Proposal

Topics in Algebraic Number Theory
Salahaddin University, Erbil – IRAQ

4–9 October 2021

1 General Information

School title: Topics in Algebraic Number Theory

Official language of the school: ENGLISH

Country: Kurdistan Region – IRAQ

Name and address of the host institution (university or equivalent): College of Sciences, Salahaddin University - Erbil, Kirkuk Road - Erbil, IRAQ

Dates: 04/10/2021-09/10/2021

2 Scientific committee

1. Cécile Armana, *Université de Franche-Comté* (cecile.armana@univ-fcomte.fr)
2. Herish Omer Abdullah, *Salahaddin University-Erbil* (herish.abdullah@su.edu.krd)
3. Elisa Lorenzo García, *Université de Rennes 1* (elisa.lorenzogarcia@univ-rennes1.fr)
4. Francesco Pappalardi, *Università Roma Tre* (pappa@mat.uniroma3.it)
5. Lea Terracini, *Università di Torino* (lea.terracini@unito.it)
6. Michel Waldschmidt, *Sorbonne Université* (michel.waldschmidt@imj-prg.fr)

Total percentage of women/men: 50%/50%

3 Organizing committee

1. Saman Ahmed Bapir, *Salahaddin University-Erbil* (saman.bapir@su.edu.krd)
2. Rashad Rashid Haji, *Salahaddin University-Erbil* (rashad.haji@su.edu.krd)
3. Jabar Salih Hassan, *Salahaddin University-Erbil* (jabar.hassan@su.edu.krd)
4. Sanhan M. Salih Khasraw, *Salahaddin University-Erbil* (sanhan.khasraw@su.edu.krd)
5. Fuad Wahid Khdhr, *Salahaddin University-Erbil* (fuad.khdhr@su.edu.krd)

6. Gashaw A. Mohammed Saleh, *Salahaddin University-Erbil* (gashaw.mohammed@su.edu.krd)
7. Andam Ali Mustafa, *Roma Tre University and Salahaddin University-Erbil* (andam.mustafa@su.edu.krd)
8. Payman Abbas Rashed, *Salahaddin University-Erbil* (payman.rashed@su.edu.krd)

Total percentage of women/men : 25%/75%

4 Scientific content

4.1 Description of the program

The school aims at providing an introduction to various basic aspects of Algebraic Number Theory and it is directed at advanced undergraduate students of Salahaddin University and others from KAR, Iraqi and neighbouring countries Universities.

There will be five courses for a total of 26 hours.

4.2 Lecturers and courses

1. Mehdi Hassani, *University of Zanjan*, (Mehdi.hassani@znu.ac.ir)
Introduction to the Dedekind zeta function of a number field
2. Elisa Lorenzo García, *Université de Rennes 1* (elisa.lorenzogarcia@univ-rennes1.fr)
Introduction to Pari-GP
3. Francesco Pappalardi, *Università Roma Tre* (pappa@mat.uniroma3.it)
Algebraic Number Theory I
4. Peter Stevenhagen, *Leiden University* (psh@math.leidenuniv.nl)
Algebraic Number Theory II
5. Neshtiman N. Sulaiman, *Salahaddin University-Erbil* (neshtiman.suliman@su.edu.krd)
TBA
6. Lea Terracini, *Università di Torino* (lea.terracini@unito.it)
Galois Theory

Total percentage of women/men : 33%/66%

4.3 Description of each course

1. ALGEBRAIC NUMBER THEORY
 - (a) Number fields
 - (b) Norms, traces, and discriminants
 - (c) Ring of integers

- (d) Ideal factorization in Dedekind rings
- (e) Decomposition and ramification
- (f) Archimedean and non archimedean absolute values

2. GALOIS THEORY

- (a) Separability and normality of field extensions. Finite Galois theory. The fundamental theorem of Galois theory. Explicit examples of Galois extensions.
- (b) Cyclotomic extensions, radical extensions, solvable extensions. Solvable groups and the insolubility of the general quintic.
- (c) Finite fields, Reduction modulo primes, Computation of Galois groups.

3. INTRODUCTION TO THE DEDEKIND ZETA FUNCTION OF A NUMBER FIELD

- (a) Riemann zeta-function, Dirichlet- L-functions Dedekind-zeta-function;
- (b) Functional equation and Analytic continuation.

4. INTRODUCTION TO PARI-GP

- (a) Basic Number Theoretic functions with Pari: prime numbers, arithmetic functions,..
- (b) Polynomials and Power Series with Pari
- (c) Linear Algebra with Pari
- (d) Sums, Products and Integrals
- (e) Basic PARI/GP commands: standard operations, for, if, ...
- (f) Algebraic Number Theory with Pari

4.4 Tentative schedule

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
08:00-09:00	opening					
09:00-09:50	GAL	GAL	ANT	ANT	ANT	ANT
10:00-10:50	ANT	ANT	GAL	DZF	DZF	DZF
11:00-11:30	<i>coffee break</i>					
11:30-12:20	PARI	PARI	ANT	ANT	TBA	TBA
12:30-15:00	<i>lunch break</i>					
15:00-15:50	GAL	GAL	<i>free afternoon</i>	PARI	PARI	closing
16:00-16:50	ANT	ANT		PARI	PARI	

- **ANT** =Algebraic Number Theory;
- **GAL** =Galois Theory;
- **DZF** =Introduction to the Dedekind zeta function of a number field;
- **PARI** =PARI-GP.

5 Practical information

5.1 Expected number of local participants

30 participants (15 women + 15 men), (20 from KAR + 10 from the rest of IRAQ)

5.2 Expected number of international participants

16 participants (6 women + 6 men) from IRAN, TURKEY, ARMENIA, GEORGIA

5.3 Housing and meals

All the international participants and international speakers will be housed at the University Guest house. The meals will be served at the University cafeteria.

6 Budget

6.1 Expected expenses

<i>Transportation costs:</i>	(speakers 3.000€, participants 3.000€)	6.000€
<i>Lodging:</i>	(10€x 7 nights x 21 people [16 participants + 5 speakers])	1.470€
<i>Meals:</i>	(71 meals (50 lunches + 21 dinners) x 6 days x 4€)	2.130€
<i>Logistics:</i>	(posters, welcome package, rentals)	300€
<i>Others:</i>	(taxi, copies,...)	300€
Total expenses :		10.200€

6.2 Anticipated funding (resources)

<i>Financial support requested from WAMS:</i>	5.000€
<i>Local funding:</i>	2.100€
<i>International funding:</i>	1600€
<i>Costs covered by lecturers: (flights)</i>	1500€
Total resources:	10.200€