



# Master Optique, Image, Vision, Multimédia Parcours Radiation and its Effects on MicroElectronics and Photonics Technologies (RADMEP)

**Diplôme** Master

**Domaine d'étude** Sciences, Technologies, Santé

**Parcours** Radiation and its Effects on MicroElectronics and Photonics Technologies (RADMEP)

## Objectifs

The 2-year (120 ECTS) European Master in Radiation and its Effects on MicroElectronics and Photonics Technologies (RADMEP) will provide a multidisciplinary and innovative programme covering the interactions between Radiation and MicroElectronics and Photonics, two Key Enabling Technologies for the future of Europe. RADMEP objective is to educate students in those advanced technologies, providing methodologies and introducing practical applications for their implementation in a variety of natural or man-made radiation-rich environments.

RADMEP has two goals: first to improve their career prospects and second to respond to the needs of the industry, agencies and society. Thanks to this EMJMD, students will develop useful professional and soft skills in the rich European cultural context. The field of radiation effects on components and systems is historically linked to space and nuclear power plants. With technological integration, components and systems have become sensitive to the natural atmospheric environment. In the 1990s, the effect of atmospheric neutrons started to be considered in the development of aircraft electronics. The integration of electronic and photonic technologies continues to evolve, today it is the electronic systems at ground level that are sensitive to natural radiation. Digital data storage has been an issue for some years now, and it is necessary to bury computers and data centers to protect them. In the context of the energy transition, where we are developing more electric aircraft, electric and autonomous mode of transportation, it is necessary to take this new constraint into account to ensure the reliability of the systems. The dismantling of nuclear power plants will require radiation-resistant optoelectronic and electronic systems, first to observe what needs to be dismantled and then to have the tools to dismantle the sites. Space is undergoing a revolution with the New Space, which consists in using commercial components to make satellites more intelligent and give them unequalled observation and analysis capacities, but which requires the reliability of these technologies, which were not originally intended for space. It will no longer be possible to develop an electronic or photonic system for which the safety of people is essential without recourse to the radiation analysis of which the students trained by the RADMEP Master's degree will be capable.

Thanks to RADMEP, students will obtain fundamental knowledge and experience in those two technologies, their behaviors under irradiation. The first semester 1 will take place at Jyväskylän yliopisto (JYU, Finland) and the semester 2 at Katholieke Universiteit Leuven (KUL, Belgium). For the third semester, a choice between two different specializations will be offered to the RADMEP students. First one, taking place at Université Jean Monnet Saint-Etienne (UJM, France) will focus its programme on Radiation Effects on Photonics technologies while the second one will focus on Radiation Effects on Microelectronics and Advanced Electronic Technologies and will take place at Université de Montpellier (UM, France). RADMEP students will undertake a 6-months master thesis either in an industrial, an agency or in a research center, for example from the large RADMEP network of more than 35 associate partners.

# Pour qui ?



## Conditions d'admission

Please see the following page for additional details regarding course entry requirements : <http://master-radmep.org/who/>

Prepare your application: <https://master-radmep.org/how/>

Application procedure: <https://master-radmep.org/application-procedure/>

# Programme

YEAR 1

Induction week held at University Jean Monnet (UJM) from August 30th to September 5th 2021

**SEMESTER 7 - University of Jyväskylä (JYU) - From September 6th to December 31st 2021**

Minimum of **30 ECTS** from the following courses

Major units - 22 ECTS	Credits	Syllabus	Instructor
Applied Semiconductor Physics	5	<a href="#">Syllabus</a>	Dr. Kai Arstila
Electron, Photon and Ion Beam Methods in Materials Science	5	<a href="#">Syllabus</a>	Prof. Timo Sajavaara
Measuring Techniques	5	<a href="#">Syllabus</a>	Dr. Panu Ruotsalainen
Numerical Methods in Physics	4	<a href="#">Syllabus</a>	Dr. Kimmo Niskanen
Workshop #1: Basics of Radiation Environments and Challenges related to radiation effects	3		Dr. Arto Javanainen Dr. Kimmo Niskanen

Optional Units - (min. 8 ECTS)	Credits	Syllabus	Instructor
Electronics part A	4	<a href="#">Syllabus</a>	Dr. Arto Javanainen
Electronics part B	4	<a href="#">Syllabus</a>	Dr. Arto Javanainen
Electronics Workshop	2	<a href="#">Syllabus</a>	Risto Kronholm
Nuclear Physics	8	<a href="#">Syllabus</a>	Prof. Iain Moore

Fission and its Applications	5	Syllabus	Dr. Heikki Penttilä
Systematic Information Seeking	1	Syllabus	Johanna Kinnunen
Creating Careers	1	Syllabus	Anu Ojala

Extra units	Credits	Syllabus	Instructor
Survival Finnish	2	Syllabus	Tuija Lehtonen
Each-one-teach-one	3	Syllabus	Tuija Lehtonen
E-Learning Module: Academic Reading/ Supplementary Module	2	Syllabus	Lilja Salmi
E-Learning Module: Academic Vocabulary	2	Syllabus	Lilja Salmi
E-Learning Module: Grammar for Writing	2	Syllabus	Hanna Bauer

### SEMESTER 8 - Katholieke Universiteit Leuven (KUL) – From February XX 2022 to June XX 2022

Minimum of **30 ECTS** from the following courses

Major units - 22 credits	Credits	Syllabus	Instructor
Analog CMOS design	3	Syllabus	Prof. Paul LEROUX
Embedded systems	5	Syllabus	Prof. Jeffrey PRINZIE
Ethics	1	Syllabus	
Digital chip design	4	Syllabus	Prof. Jeffrey PRINZIE
Analog and mixed signal chip design and image sensors	6	Syllabus	Prof. Paul LEROUX and Dr. Guy MEYNANTS
Workshop #2: Basics of Photonics Technologies and	3		Dr. Guy MEYNANTS (Guest lecturers: Prof. Heidi

Their use in Harsh Environments			OTTEVAERE (VUB Brussels), Prof. Wim BOGAERTS (UGent)
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Optional units (min. 8 credits)	Credits	Syllabus	Instructor
Machine Learning	4	Syllabus	Prof. Peter KARSMAKERS
Big Data	4	Syllabus	Prof. Peter KARSMAKERS / Prof. Mariya ISHTEVA
Radiation to electronics project	4	Syllabus	Prof. Valentijn DE SMEDT
RF and PLL Design	4	Syllabus	Prof. Paul LEROUX
Digital Signal Processing	4	Syllabus	Prof. Peter KARSMAKERS

Extra credits	Credits	Syllabus	Instructor
Survival Dutch – 40h of lectures including also some excursions	3		
2-month internships	10	Syllabus	

**YEAR 2 - 2 tracks available**

**SEMESTER 9 – From September XX 2022 to January XX 2023**

**TRACK 1: Photonics Specialization - Courses at University Jean Monnet (UJM)**

Minimum of **30 ECTS** from the following courses

Major units	Credits	Syllabus	Instructor
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<b>22 credits</b>			
Laser Physics	4	Syllabus	Prof. Youcef Ouerdane / Prof. Sylvain Girard
Optical Engineering	2	Syllabus	Arnaud Meyer
Advanced Photonic and Optoelectronic Technologies	5	Syllabus	Ass. Prof. Adriana Morana, Prof. Sylvain Girard, Prof. Emmanuel Marin and external RADMEP guest lecturers
Radiation Effects on Photonic and Optoelectronic Technologies	5	Syllabus	Ass. Prof. Adriana Morana, Prof. Sylvain Girard, Prof. Emmanuel Marin and external RADMEP partners
Photonics Labs	3	Syllabus	Prof. Emmanuel Marin, Ass. Prof. Adriana Morana
Workshop #3: @CERN Simulation tools for Radiation-Matter Interaction and radiation effects on materials, components and systems	3	Syllabus	

<b>Optional Units - min. 8 credits</b>	<b>Credits</b>	<b>Syllabus</b>	<b>Instructor</b>
Digital Innovation and Entrepreneurship	5	Syllabus	Ass. Prof. Stéphane Foliard
Scientific Methodology and Project Management	3	Syllabus	Nathalie Destouches
Analytical Instrumentation for Detection	3	Syllabus	Ass. Pr. A. Morana, Dr. R. Stoian

Radiation to photonics project	2	Syllabus	Ass. Prof. A. Morana, Prof. S. Girard
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Extra units	Credits	Syllabus	Instructor
French language and culture	5		

## TRACK 2: MicroElectronics Specialization - Courses at University of Montpellier (UM)

Minimum of **30 ECTS** from the following courses

Major units - 20 credits	Credits	Syllabus	Instructor
Radiation and Reliability of Electronics for Transport, Aerospace and Nuclear	3	Syllabus	
Test and reliability of Integrated Circuits and Systems	5	Syllabus	
Industrial Tools and methodologies for devices qualification for space missions	3	Syllabus	
Embedded electronics and wireless communication	6	Syllabus	
Workshop #3: @CERN Simulation tools for Radiation-Matter Interaction and radiation effects	3	Syllabus	

Optional units - min.	Credits	Syllabus	Instructor
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10 credits			
Digital Innovation and Entrepreneurship	5	Syllabus	Prof. Stéphane Foliard
Acoustic sensors with associated systems	5	Syllabus	
Optical and thermal sensors with associated systems	5	Syllabus	
System on Chip and Embedded systems	5	Syllabus	

Extra credits	Credits	Syllabus	Instructor
French language and culture	5	Syllabus	

## SEMESTER 10 – From February/March 2023 to July/August 2023

Master's Thesis

- > Can be done in a company or research center.
- > Minor (optional) units are available in a research center: Scientific or Language and Culture units.

## Coût de l'inscription

4500€

### Détail coût d'inscription

4500 € per year for students from a programme country.

9000 € per year for students from a partner country.

Self-funded students will be able to pay participation costs in three instalments.

Scholarships available

See more here: <http://master-radmep.org/participation-costs/>