

## Erasmus Mundus Joint Master's Degree Photonics for Security Reliability and Safety (PSRS)

Photonics for Security Reliability and Safety (PSRS) is a two-year (120 ECTS) Erasmus Mundus Joint Master Degree, aiming to train the next generation of highly-skilled experts in advanced imaging technologies, cutting-edge image processing, computational imaging, artificial intelligence technologies, biometrics, pattern recognition, behavioral analysis, spectrometry methodologies, photonic-based sensors, micro-nano-technologies, laser processing and surface functionalization to address the current and future societal challenges related to security and safety of people, goods and environment.

Students will be educated through a strong interaction with industrial partners to application fields as various as: detections of dangerous and/or illegal goods, detection of suspect individuals at borders, signature identification for cashless payment, fighting against counterfeiting, forensics and security markings, analysis of biological systems, detection of driver drowsiness, identification systems in case of medical emergency, measurement of inter-vehicle distances, biomedical applications, medical diagnostics, pollution control, driver vision enhancement, driving assistance (collision avoidance systems), industrial production control, help for a more efficient agriculture, food safety, lab-on-chip biosensors, identification of chemical substances and biological or inorganic materials, high precision fabrication of photonic devices, generation of functional surfaces and advanced materials in industry.

PSRS is implemented by a consortium of four European universities:

Université Jean Monnet Saint-Etienne (France), University of Eastern Finland, Politecnico di Torino (Italy) and Université Paris-Est Créteil Val de Marne (France), together with 26 academic partners and 24 industrial leaders across the globe.

### **Learning outcomes:**

At the end of the PSRS Programme, the student should be able to:

1. Apply knowledge of photonics, data science and micro-nanotechnology fundamentals
2. Design and conduct experiments involving imaging, technologies, micro-nanotechnologies or laser processes
3. Analyze and interpret data by data processing or artificial intelligence methods
4. Identify, formulate and solve photonics or digital photonics problems
5. Design a system, component or process to meet industrial needs
6. Function on multidisciplinary, multicultural and geographically spread teams
7. Understand the professional and ethical responsibility
8. Communicate effectively in oral, written and other media forms
9. Have a broad education necessary to understand the impact of science solutions in a global and societal context and to advance sustainability
10. Recognize the need to engage in lifelong learning and the ability to do so

The definition of above learning qualities are variable as they are the result of the close involvement of our industrial partners in the learning design of PSRS. Hence they are likely to change from one semester to another to best meet the requirements of employers.

Successful completion of the PSRS Erasmus Mundus Joint Master Degree will result in the award of multiple Master's degrees (i.e. 4 national diplomas issued by 4 higher education institutions from 4 European countries and fully recognized in these respective countries). In line with the Bologna Accords, those degrees benefit from a wide recognition in Europe and beyond.

According to the concentration which has been chosen by the graduate, the consortium will deliver either multiple diplomas from:

- UJM, UEF and UJM (specialization in Opto-digital imaging, laser processing and machine learning)
- OR UJM, UEF and UPEC (specialization in Biometrics)
- OR UJM, UEF and PoliTo (specialization in Micro-nano-technological devices)

Mobility scheme: <https://www.master-photonics4security.eu/Mobility>

The curriculum of the PSRS program and the course descriptions can be seen here: <https://www.master-photonics4security.eu/Curriculum-and-mobility>

The courses offered at UEF (Semester 2) are listed in the table below.

Course code	Course	Obligatory course	Lecturer	Teaching schedule	Timing	ECTS
3312079	Photonics Laboratory	Yes	Hannu Laamanen	spring term	1 <sup>st</sup> year	8
3312020	Light and Matter	Yes	Yuri Svirko	spring term	1 <sup>st</sup> year	4
3312021	Material Physics	X o	Pasi Vahimaa	spring term	1 <sup>st</sup> year	4
3312060	Micro- and nanophotonics	No	Jari Turunen	spring term	1 <sup>st</sup> year	4
3312062	Color Science	o	Martti Mäkinen	spring term	1 <sup>st</sup> year	4
3312078	Basics of Signal and Image Processing	X	Hannu Laamanen	spring term	1 <sup>st</sup> year	5
3621518	<i>Machine Vision</i>	X	<i>School of Computing</i>	<i>spring term</i>	<i>1<sup>st</sup> year</i>	5
3313005	Advanced Biomedical Optics	No	Pertti Silfsten	spring term (every other year)	1 <sup>st</sup> year	4
3312064	Optical Design 1	No	Jari Turunen	spring term	1 <sup>st</sup> year	4
3312048	Components for optical telecommunications	No	Matthieu Roussey	spring term	1 <sup>st</sup> year	4
3312025	Display Technology	No	Pertti Silfsten	spring term	1 <sup>st</sup> year	5
3313008	Commercializing high-tech	No	Jyrki Saarinen	spring term (every other year)	1 <sup>st</sup> year	4

<b>3312081</b>	Numerical Methods with Python in Photonics		Henri Pesonen	spring term	1 <sup>st</sup> year	2
<b>XcodeX</b>	<i>Finnish language course</i>	<i>No</i>	<i>Language centre</i>	<i>spring term</i>	<i>1<sup>st</sup> year</i>	<i>2</i>

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**X** = mandatory prerequisites to study at PoliTo during the 3rd semester

**o** = mandatory prerequisites to study at UJM during the 3rd semester