

## Master's Degree Programme in Photonics

Academic years 2021-22

Master's Degree Programme in Photonics is an international two-year fulltime study program. Degree consists of 120 ECTS credits of studies in one main subject, photonics.

### LEARNING OBJECTIVES

The objective of Master's degree in photonics is to give students good expertise on modern optics and photonics in both theoretical and experimental level. This contains ability to understand optical phenomena, design and analysis of optical systems, fabrication methods of photonics structures, and ability to scientific and technical communication in photonics. This all gives capability to work in photonics related companies as an expert and developer, and to continue to PhD studies in photonics. The education is based on high-quality photonics research in the department.

Filosofian maisterin tutkinto (120 op)

#### **Pääaine fotonikka / fysiikka**

*Yleisopinnot (1 op)*

3310302 Maisterin tutkinnon HOPS 1 op

3310306 Fotonikan numeeriset menetelmät\* 2 op

*\*Kurssi on pakollinen niille opiskelijoille, joiden pääaine on fotonikka*

*Kieli- ja viestintäopinnot (2 op)*

English Academic and Professional Communication for Students of Natural Sciences and Forestry (8013449)\*\* 2 op

*\*\*Kurssi on pakollinen niille opiskelijoille, joiden pääaine on fysiikka*

3314231 Fotonikan syventävät opinnot (vähintään 117 op)

3312056 Epälineaarinen optiikka 4 op

3312055 Fotonikan ja optiikan perusteet 4 op

3312057 Fotonikan matemaattiset menetelmät 4 op

3312008 Fysikaalinen optiikka 4 op

3312016 Kvanttifysiikka 4 op

3312059 Kvanttioptiikka 4 op

3312058 Laserfysiikka 4 op

3312052 Luonnontieteilijän data- ja virheanalyysi 2 op

3312021 Materiaalifysiikka 4 op

3312020 Materiaalien optisten ominaisuuksien mallintaminen 4 op

3312060 Mikro- ja nanofotonikka 4 op

3312064 Optinen suunnittelu: geometrinen optiikka 4 op

3312027 Optinen suunnittelu: numeerinen mallintaminen 4-5 op

3312048 Optisen tietoliikennetekniikan komponentit 4 op

3312071 Laitteistojen kontrollointi graafisen ohjelmoinnin avulla 2 op

3312073 Fotonikan sovellukset 4 op

3312062 Värioppi 4 op

3312032 Syventävien opintojen mittausten menetelmäkurssi ja syventävät työt 17 op

3312063 Viestintätaidot 4 op

3312005 Fysiikan pro gradu -seminaari 2 op

3312420 Pro gradu -tutkielma ja kypsyysnäyte 30 op

*Vapaaehtoisesti suoritettavia ylimääräisiä kursseja:*

3312012 Harjoittelu (2-6 op)

3312025 Näyttötekniologia (5 op)

3312039 Paperi- ja painotuotteiden optiset ominaisuudet (4 op)

1131003 Orientation for International Students (1 op)

8014301 Suomi 1 (4 op) *(kurssi on tarkoitettu tutkinto-opiskelijoille)*

8014300 Survival Finnish (2 op) *(kurssi on tarkoitettu vaihto-opiskelijoille)*

3312078 Basics of Signal and Image Processing (5 op)

8031006 University Computing Skills (2 op)

8031003 University Study Skills (1 op)

3313002 Optiikan kesäkoulu (2 - 5 op)

CODE	Course	Obligatory course	Lecturer	Teaching schedule (period)	Timing	ECTS
<b>GENERAL STUDIES</b>						
1131003	Orientation for International Students	No	Päivi Haltilahti	1	1st year	1
3310302	Study Planning	Yes	Noora Heikkilä	1	1st year	1
3312063	Communication Skills	Yes	Markku Kuittinen	1-2	1st year	4
3312005	Master's Thesis Seminar in Physics	Yes	Markku Kuittinen	4	2nd year	2
8014301	Finnish 1	No	Language Centre	1	1st year (degree students)	4
8014300	Survival Finnish	No	Language Centre	3	only for exchange students	2
8031006	University Computing Skills	No	Student and Learning Services	1	1st year	2
8031003	University Study Skills	No	Student and Learning Services	1	1st year	1
<b>CORE</b>						
3312055	Photonics and Optics Fundamentals	Yes	Pasi Vahimaa	1	1st year	4
3312008	Physical Optics	Yes	Matthieu Roussey	2	1st year	4
3312021	Material Physics	Yes	Pasi Vahimaa	3	1st year	4
3312016	Quantum Physics	Yes	Pasi Vahimaa	2	1st year	4
<b>LABORATORY</b>						
3312032	Advanced Measurements and Laboratory Practice	Yes	Pertti Pääkkönen	1	1st year	2
3312032	Laboratory Practice 1	Yes	Various	2-4	1st year	9
3312032	Laboratory Practice 2	Yes	Various	autumn	2nd year	3

CODE	Course	Obligatory course	Lecturer	Teaching schedule (period)	Timing	ECTS
3312032	Laboratory Practice 3	Yes	Various	autumn	2nd year	3
3312071	Graphical programming for setup control	Yes	Viatcheslav Vanyukov	1	2nd year	2
<b>WAVES AND SCATTERING</b>						
3312060	Micro- and nanophotonics	Yes	Jari Turunen	4	1st year	4
3312064	Optical Design: geometrical optics	Yes	Jari Turunen	3	1st year	4
3312027	Optical Design: numerical modelling	Yes	Pertti Pääkkönen	2	2nd year	4-5
<b>LIGHT AND MATTER</b>						
3312020	Light and Matter	Yes	Yuri Svirko	4	1st year	4
3312059	Quantum Optics	Yes	Ari Friberg / Tommi Hakala	1	2nd year	4
3312056	Nonlinear Optics	Yes	Yuri Svirko	2	2nd year	4
3312058	Laser Physics	Yes	Tero Setälä	1	2nd year	4
<b>DISPLAYS, COLORS, APPLICATIONS</b>						
3312062	Color Science	Yes	Martti Mäkinen	3	1st year	4
3312073	Applications of Photonics	Yes	Jyrki Saarinen	2	2nd year	4
3312025	Display Technology	No	Markku Kuittinen	2	2nd year	5
3312048	Components for optical telecommunications	Yes	Matthieu Roussey	4	1st year	4
3312039	Paper and Printing Optics	No	Martti Mäkinen	summer		4
<b>OTHERS</b>						
3310306	Numerical Methods in Photonics	Yes	Kimmo Saastamoinen	1	1st year	2
3312057	Mathematical methods for Photonics	Yes	Markku Kuittinen	1	1st year	4
3312052	Data and Error Analysis in Natural Sciences	Yes	Hannu Laamanen	2	1st year	2
3312078	Basics of Signal and Image Processing	No	Hannu Laamanen	3		5
3312012	Professional Training	No	Noora Heikkilä	summer		2-6
3313002	Joensuu Summer School on Optics	No	Various	summer		2-5

Concerning all courses of the Department of physics and Mathematics, they can be arranged by the decision of the lecturer as hybrid- or remote teaching. Then, for exams, the remote supervision arrangements of exams (see <https://kamu.uef.fi/en/student-book/ethical-guidelines-for-teaching-and-studying/>, section 2) can be taken on use.