

### Curriculum master Applied Physics for students enrolled 2023/2024

First and second year (M1 en M2)		
Course code	Name	EC
<b>M1</b>		
<b>Compulsory courses (20 EC)</b>		
202200093	Quantum Mechanics 2	5
201900080	Mathematical and Numerical Physics	5
191470241	Heat and Mass Transfer	5
201900282	Small Signals and Detection	4
201900281	Ethical and Cultural Awareness	1
<b>Specialisation courses (20 EC)</b>		20
<b>Elective courses physics/technical</b>		10
<b>Elective courses free</b>		10/0
<b>M2</b>		
<b>Internship, 193599010 / 201700185</b>		20/30
<b>Master's Assignment, General Aspects 201800345 / Physics Aspects 201800344</b>		40
<b>Total master</b>		<b>120</b>

### Specialisation courses Applied Physics

Organised in research clusters

Applied Nanophotonics		
<b>General Applied Nanophotonics</b>		
<i>Specialisation course</i>		
202200044	Fundamentals of Photonics	5
<b>Biomedical Optics</b>		
<i>Specialisation courses</i>		
202200295	Laser Physics and Nonlinear Optics	5
202000663	Molecular Structure and Spectroscopy (part of AT module 9)	2.5
193500000	Biomedical Optics	5
<b>Integrated Optics</b>		
<i>Specialisation courses</i>		
202200295	Laser Physics and Nonlinear Optics	5
191210880	Integrated Optics	5
202200045	Integrated Photonic Systems and Experiments	5
<b>Light and Matter Interaction</b>		
<i>Specialisation courses</i>		
202200046	Light and Matter	5
202200047	NanoPlasmonics	5
202200048	Quantum and Classical Emitters	5
<b>Quantum Optics</b>		
<i>Specialisation courses</i>		
202100083	Quantum Optics	5
191210880	Integrated Optics	5
202100078	Quantum Information	5
<i>Recommended elective courses ANP cluster</i>		
-	All courses from the other specialisations within the ANP cluster	
201700034	Introduction to Partial Differential Equations	5
201500405	Complex Function Theory	3
202200103	Image Processing and Computer Vision	5

### Energy, Materials and Systems

#### Energy Materials & Systems (EMS), prof.dr.ir. H.J.M. ter Brake

##### Specialisation courses

193530000	Introduction to Superconductivity	5
201100214	Applications of Superconductivity	5
201100146	Cryogenic Science and Technology	5
-	Course in consultation with chair	5

##### Recommended elective courses:\*

193570010	Advanced Fluid Mechanics	5
193510040	Theoretical Solid State Physics	5
193550020	Surfaces and Thin Layers	5
193530040	Introduction to High Energy Physics	5
193530010	Nanophysics	5
193580020	Experimental Techniques in Physics of Fluids	5
201700026	Electrical Power Engineering and System Integration	5
201400037	Linear Solid Mechanics	5
201800131	Numerical Methods for Engineers	5
193565000	Capillarity Phenomena	5

### Nano Electronic Materials

#### Computational Chemical Physics(CCP), prof.dr. C. Filippi

##### Specialisation courses

193570050	Advanced Quantum Mechanics	5
193510040	Theoretical Solid State Physics	5
202100210	Electronic Structure Theory	5
-	Course in consultation with chair	5

##### Recommended elective courses:\*

202100223	Computational Physics	5
202100224	Machine Learning	3/5
202000694	Classical Mechanics	4
193570040	Theory of General Relativity	5
201500405	Complex Function Theory	5
202100078	Quantum Information	3
193530010	Nanophysics	5
200900066	Introduction to the Physics of Correlated Electrons	5

#### Industrial Focus Group XUV Optics (XUV), prof.dr. M.D. Ackermann

##### Specialisation courses

193530010	Nanophysics	5
193550020	Surfaces and Thin Layers	5
202300191	X-rays for Science and Technology	5
1 out of 3:		
193700040	AMM-Inorganic Materials Science	5
193700010	AMM-Characterisation	5
202200044	Fundamentals of Photonics	5

##### Recommended elective courses, the aforementioned 3 plus:\*

193510040	Theoretical Solid State Physics	5
193570050	Advanced Quantum Mechanics	5
191210730	Technology	5
201900042	Nanomaterials Research	5

<b>Inorganic Materials Science (IMS), prof.dr.ing. A.J.H.M. Rijnders</b>		
<i>Specialisation courses</i>		
193700010	AMM-Characterization	5
193700040	AMM-Inorganic Materials Science	5
-	Course in consultation with chair	5
1 out of 3:		
193550020	Surfaces and Thin Layers	5
202200044	Fundamentals of Photonics	5
201700025	Solar Energy	5
<i>Recommended elective courses:*</i>		
193510040	Theoretical Solid State Physics	5
193530010	Nanophysics	5
201300139	Laser Physics	5
200900066	Introduction to the Physics of Correlated Electrons	5
193530000	Introduction to Superconductivity	5
<b>Interfaces and Correlated Electron Systems (ICE), prof.dr.ir. J.W.M. Hilgenkamp</b>		
<i>Specialization courses</i>		
193510040	Theoretical Solid State Physics	5
193530010	Nanophysics	5
193530000	Introduction to Superconductivity	5
-	Course in consultation with chair	5
<i>Recommended elective courses:*</i>		
200900066	Introduction to the Physics of Correlated Electrons	5
202100078	Quantum Information	5
<b>Physics of Interfaces and Nanomaterials (PIN), prof.dr.ir. H.J.W. Zandvliet</b>		
<i>Specialisation courses</i>		
193530010	Nanophysics	5
193550020	Surfaces and Thin Layers	5
201500167	Modern Topics in Condensed Matter Physics	5
-	Course in consultation with chair	5
<i>Recommended elective courses:*</i>		
193510040	Theoretical Solid State Physics	5
200900066	Introduction to the Physics of Correlated Electrons	5
201100254	Advanced Computer Vision and Pattern Recognition	5
<b>Quantum Transport in Matter (QTM), prof.dr.ir. A. Brinkman</b>		
<i>Specialisation courses</i>		
193510040	Theoretical Solid State Physics	5
193530010	Nanophysics	5
193530000	Introduction to Superconductivity	5
-	Course in consultation with chair	5
<i>Recommended elective courses:*</i>		
200900066	Introduction to the Physics of Correlated Electrons	5
202100078	Quantum Information	5

### Physics of Fluids

#### Physics of Fluids (PoF), prof.dr. D. Lohse

##### Specialisation courses

193570010	Advanced Fluid Mechanics	5
193580020	Experimental Techniques in Physics of Fluids	5
10 EC out of:		
193565000	Capillarity Phenomena (recommended)	5
193580010	Turbulence (recommended)	5
201400194	Granular Matter	5
		2.5
193572010	Physics of Bubbles	2.5
193542070	Medical Acoustics	5
1 out of 2 (not both, due to overlap):		
201800131	Numerical Methods for Engineers	5
191154731	Computational Fluid Dynamics	5

##### Recommended elective courses, all of the above plus:\*

201500405	Complex Function Theory	3
191560430	Nonlinear Dynamics	5
202001413	Soft Matter Physics	5
193400121	Nano-Fluidics	5

### Soft Matter

#### BioElectronics (BE), prof.dr. S.J.G. Lemay

##### Specialisation courses

202001413	Soft Matter Physics	5
202001414	Physical Biology	5
193400121	Nano-Fluidics	5
-	Course in consultation with chair	5

##### Recommended elective courses:\*

193565000	Capillarity Phenomena	5
201800083	Advanced Colloids and Interfaces	5
201700187	Soft and Biological Techniques**	5

#### Nano BioPhysics (NBP), prof.dr. M.M.A.E. Claessens

##### Specialisation courses

202001414	Physical Biology	5
193640020	Biophysical Techniques and Molecular Imaging	5
-	Courses in consultation with chair	10

##### Recommended elective courses:\*

202001413	Soft Matter Physics	5
202200048	Classical and Quantum Emitters	5
193400111	Bionanotechnology	5
201700187	Soft and Biological Techniques**	5
202200044	Fundamentals of Photonics	5
193400131	Nano-Optics	5
202200295	Laser Physics Nonlinear Optics	5
202200045	Integrated Photonic Systems and Experiments	5
193700010	AMM-Characterization	5

### Physics of Complex Fluids (PCF), prof.dr. F.G. Mugele

#### Specialisation courses

193565000	Capillarity Phenomena	5
193400121	Nano-Fluidics	5
202001413	Soft Matter Physics	5
-	Course in consultation with chair	5

#### Recommended elective courses\*:

201800083	Advanced Colloids and Interfaces	5
201700187	Soft and Biological Techniques**	5
193570010	Advanced Fluid Mechanics	5
193730060	Polymer Physics	2.5
		5

### Physics of Complex Fluids (PCF), prof.dr. F.G. Mugele

#### Specialisation courses

193565000	Capillarity Phenomena	5
193400121	Nano-Fluidics	5
202001413	Soft Matter Physics	5
-	Course in consultation with chair	5

#### Recommended elective courses\*:

201800083	Advanced Colloids and Interfaces	5
201700187	Soft and Biological Techniques**	5
193570010	Advanced Fluid Mechanics	5
193730060	Polymer Physics	2.5
		5

\* For every chair, a specific Capita Selecta course (CS) is available, for activities done in the chair not longing to regular courses. The content, form and size are in agreement with the chair. There is a [Grade form CS courses AP](#) to register course code, name, EC, subject, material used, assessment and title.

\*\* Soft and Biological Techniques requires previous knowledge, depending on your specific background. In addition, there is a maximum number of students that can participate. Please contact [Michel Duits](#).

<b>Quantum Physics</b>				
In the Quantum Physics specialisations, master's assignments can be carried out in the following research groups; AQO, NLNP, IOS, COPS, MBP, OS, HMOE. <sup>1</sup>				
<b>Quantum Electronics</b>				
<i>Compulsory specialisation courses</i>				
	<b>Code</b>	<b>Name</b>	<b>Quartile</b>	<b>EC</b>
	202100078	Quantum Information (Renema)	Q1	5
	193570050	Advanced Quantum Mechanics (Brocks)	Q2	5
Quantum Electronics Electives 10 EC of;				
	193530010	Nanophysics (Zandvliet)	Q1	5
	193530000	Introduction to Superconductivity (Dhalle)	Q1	5
	193510040	Theoretical Solid State Physics (Kelly)	Q2	5
	193530040	Introduction to High Energy Physics (Du Pree)	Q2	5
	193400141	Nano-Electronics (Van der Wiel)	Q2	5
	200900066	Introduction to Physics of Correlated Electrons (Golubov)	Q4	5
	202100210	Electronic Structure Theory (leppert)	Q4	5
Physics/Technical electives <sup>2</sup> 10 EC				10
Free electives <sup>3</sup>				10/0
In the Quantum Electronics specialisation, master's assignments can be carried out in the following research groups; QTM, NE, PIN, CCP, ICE				
<b>Quantum Optics</b>				
<i>Compulsory specialisation courses</i>				
	<b>Code</b>	<b>Name</b>	<b>Quartile</b>	<b>EC</b>
	202100078	Quantum Information (Renema)	Q1	5
	193570050	Advanced Quantum Mechanics (Brocks)	Q2	5
Quantum Electronics Electives 10 EC of;				
	202200044	Fundamentals of Photonics	Q1	5
	202100083	Quantum Optics (Pinkse)	Q2	5
	191210880	Integrated Optics (Garcia Blanco)	Q3	5
Physics/Technical electives <sup>2</sup> 10 EC				10
Free electives <sup>3</sup>				10/0
In the Quantum Optics specialisations, master's assignments can be carried out in the following research groups; AQO, NLNP, IOS, COPS, MBP, OS, HMOE.				

<sup>1</sup> If you prefer to carry out the master's assignment at another research group or outside UT, please contact the study advisor of Applied Physics

<sup>2</sup> In consultation with the research chair of the master's assignment

<sup>3</sup> Instead of 10 EC free electives at a master level students can choose to extend the internship with 10 EC (30 instead of 20 EC)

<b>Multidisciplinary Specialisations</b>				
<i>The multidisciplinary master's specialisation is a shared specialisation programme with another master's degree programme. The study programme consists of the compulsory part of the AP master's with the shared specialisation courses.</i>				
<b>Fluid Mechanics Multidisciplinary Specialisation (AP/ME)</b>				
<b>Physics of Fluids (PoF), prof.dr. D. Lohse / Engineering Fluid Dynamics (EFD) prof.dr.ir. C.H. Venner</b>				
<i>Specialisation courses</i>				
<i>10 EC out of:</i>				
	193570010	Advanced fluid mechanics	Q1	5
	201500136	Fluid Mechanics II	Q1	5
	193580020	Experimental Techniques in Physics of Fluids	Q3	5
<i>Elective courses</i>				
<i>Max 10 EC out of:</i>				
	201900074	Fundamentals of Numerical Methods	Q1	5
	201900091	Advanced Topics in Finite Element Methods	Q2	5
	191154731	Computational Fluid Dynamics	Q4	5
	201800131	Numerical methods for engineers	Q4	5
<i>Max 5 EC out of:</i>				
	191157750	Engineering Acoustics	Q1	5
	202200103	Image processing and computer vision	Q1	5
	201800371	Aeroacoustics	Q3	5
	201100254	Advanced computer vision and pattern recognition	Q4	5
<i>Recommended elective courses</i>				
	201800083	Advanced colloids and interfaces	Q1	5
	202000245	Experimental methods in Fluid and Thermal Engin	Q1	5
	191560430	Nonlinear dynamics	Q1	5
	201500024	Advanced Thermodynamics	Q2	5
	191154720	Fluid Mechanics of Turbomachines 1	Q2	5
	202200266	Hydrogen Technology	Q2	5
	201800327	Ion Transport in Fluids	Q2	2,5
	193572010	Physics of bubbles	Q2	2,5
	193580010	Turbulence	Q2	5
	202000244	Aircraft & Wind Turbine Aerodynamics	Q3	5
	202001436	Biofluid Dynamics	Q3	5
	191154340	Gasdynamics	Q3	5
	201400194	Granular matter	Q3	5
	193400121	Nano-fluidics	Q3	5
	191121740	Rheology & Processing of Thermoplastics	Q3	5
	202001413	Soft matter physics	Q3	5
	191155730	Tribology	Q3	5
	201700218	Turbulent Combustion	Q3	5
	193565000	Capillarity phenomena	Q4	5
	201500405	Complex function theory	Q4	3
	201400195	Fluids and elasticity	Q4	2,5
	201400300	Multiphase Flows	Q4	5
	201700024	Wind Energy	Q4	5

<b>Materials, Science and Engineering Multidisciplinary Specialisation (AP/CSE)</b>				
<i>Compulsory joint specialisation courses</i>				
	193700010	AMM- Characterization	Q1	5
	193700040	AMM- Inorganic Materials Science	Q3	5
	193550020	Surfaces and Thin Layers	Q3	5
	202100319	Phase transformations in manufacturing	Q4	5