Interdepartmental Postgraduate Program

“Cutting Edge Technologies in Vision Sciences”

Course Outlines

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COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**			
ACADEMIC UNIT				
LEVEL OF STUDIES	**POSTGRADUATE**			
COURSE CODE	**TAO - 101**	**SEMESTER**	**1**	
COURSE TITLE	**EYE AND VISION I**			
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*			**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures			4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background			
PREREQUISITE COURSES	None			
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English			
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)				

(2) LEARNING OUTCOMES

Learning outcomes *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.* *Consult Appendix A* • *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area* • *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B* • *Guidelines for writing Learning Outcomes*
Upon successful completion of the course, students will be able to: • Know *The course according to the European Qualifications Framework for Lifelong Learning belongs to level 7.*

General Competences *Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?*	
Search for, analysis and synthesis of data and information, with the use of the necessary technology *Adapting to new situations Decision-making* *Working independently Teamwork* *Working in an international environment* *Working in an interdisciplinary environment Production of new research ideas*	*Project planning and management* *Respect for difference and multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking .....* *Others...* *.....*
• Capacity to address complex problems. • Development of scientific thought • Use of the University Library and multiple bibliographic references • Searching sources, simulations, and electronic courses on the internet • Taking notes and development of independent methods of studying • Writing research reports • Efficient management of time and deadlines • Development of the ability to present concepts in a succinct form	

(3) SYLLABUS

1) Fundamentals

(4) TEACHING and LEARNING METHODS - EVALUATION

Delivery *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of slides • Videos with demonstration/understanding experiments. • Use of an asynchronous e-learning platform (e-learn) where the following are provided: o *Bibliography of the course* *o Slides of the course* *o Self-study Exercise Set* *o Lecture videos* *o Demonstration videos and simulations* *o* Communication through the e-learn platform, use of the discussion area facility with topics, email as well as fixed office hours announced • Students' assignments are received and corrected via the platform (e-learn)

TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	***Activity***	***Semester workload***
	Lectures	48 (18 x 2 + 4 x 3)
	Assignments/Projects	30 (15/15)
	Directed learning activity (office hours)	
	Non-directed learning activity	90 (3 hours study/presentation during the semester (18) and 2 hours study/presentation as preparation for the final exam)
	Course total	**168**
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically defined evaluation criteria are given, and if and where they are accessible to students.*	Language of Evaluation: English The final grade is the sum of the final written examination (100%).	

(5) ATTACHED BIBLIOGRAPHY

Bibliography

- *Lecture notes*
- *ER Kandel, JH Schwartz, TM Jessell. Principles of Neural Science, 6th edition, McGraw-Hill.*
- *MF Bear, BW Connors, MA Paradiso. Neuroscience: Exploring the Brain, 3rd edition, 2007*

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE AND SCIENCES AND TECHNOLOGY**		
ACADEMIC UNIT	**MEDICINE, MATERIALS MECHANICS AND TECHNOLOGY, MATHEMATICS AND APPLIED MATHEMATICS**		
LEVEL OF STUDIES	**POSTGRADUATE**		
COURSE CODE	**TAO - 102**	**SEMESTER**	**1**
COURSE TITLE	**MATHEMATICS I**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.
Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, students will be able to:

- use basic mathematical tools in applications related to optics and vision technologies
- understand the process of mathematical modeling of complex problems arising from

the medical sciences.

- be able to solve simple mathematical modeling problems that use tables and detailed description of curves and surfaces.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations Decision-making	*Respect for difference and multiculturalism*
Working independently Teamwork	*Respect for the natural environment*
Working in an international environment	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Working in an interdisciplinary environment Production of new research ideas	*Criticism and self-criticism*
	Production of free, creative and inductive thinking .....
	Others...
	.....

- Capacity to address complex problems of mathematical modelling.
- Development of scientific thinking.
- Work in a intertdisciplinary environment.
- Promotion of creative and inductive thinking.
- Use of the University Library and multiple bibliographic references
- Searching sources, simulations, and electronic courses on the internet
- Autonomous and teamwork.

(3) SYLLABUS

1. FUNCTIONS & GRAPHS
   1.1. Elementary functions
   1.2. Graphic representations
2. LINEAR ALGEBRA & ANALYTIC GEOMETRY
   2.1. Linear systems
      2.1.1 Graphical solution
      2.1.2. Solve by elimination
      2.1.3. Representation of systems with tables
   2.2. Matrices & determinants
      2.2.1. Operations between matrices
      2.2.2. Inverse matrix & calculation methods
   2.3. The concept of linear mapping. Eigenvalues & eigenvectors
   2.4. Analytic geometry
      2.4.1. Points & vectors in multidimensional spaces
      2.4.2. Inner product
      2.4.3. Parametric representation of lines & planes
3. DISCRETE TIME MODELS & SEQUENCES
   3.1. Models of population change in discrete time
   3.2. The concept of regression equation
   3.3. Heuristic definition of sequence & sequence limit
   3.4. The concept of series as a sequence of sums
   3.5. Modeling with regression equations

4. LIMITS & CONTINUITY OF FUNCTIONS
   4.1. Heuristic presentation of the limit of functions
   4.2. Calculation of limits
   4.3. The concept of continuity and its role in modeling
5. DERIVATIVE OF FUNCTIONS & APPLICATIONS
   5.1. Heuristic definition of the derivative
   5.2. Derivative properties & calculating derivatives of useful functions
   5.3. Derivatives of complex functions
   5.4. Linear approximation & errors (population evolution equation)
   5.5. Extremes, monotony & convexity
   5.6. Graphical representations & asymptotics
   5.7. Optimization
   5.8. The Newton & Raphson method
   5.9. Antiderivative & definite integral
6. INTEGRATION OF FUNCTIONS & APPLICATIONS
   6.1. Heuristic definition of the definite integral
   6.2. Properties and calculation of useful integrals
   6.3. Applications of the definite integral
   6.4. Taylor approximation
   6.5. The basic idea of numerical integration

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>Delivery
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of slides
• Use of an asynchronous e-learning platform (e-class) where the following are provided:
o Bibliography of the course
o Slides of the course
o Solved and unsolved exercises
o Communication through the e-class platform, use of the discussion area facility with topics, email as well as fixed office hours announced.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Assignments/Projects</td><td>30</td></tr>
<tr><td>Directed learning activity (office hours)</td><td>26</td></tr>
<tr><td>Non-directed learning activity</td><td>66</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>174</td></tr>
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The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically defined evaluation criteria are given, and if and where they are accessible to students.*	Language of Evaluation: English The final grade is the sum of 30% of a progress compulsory examination 70 % of the final written examination If the final exam grade is higher than the progress grade, the final grade is that of the final written exam.

(5) ATTACHED BIBLIOGRAPHY

Bibliography-

- C.Neuhauser & M. Ropper, Calculus for Biology and Medicine, 4th edition, Pearson, 2018
- J.R. Hass, C. Heil & M D. Weir, Thomas' Calculus in SI Units, Pearson, 2019

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of SCIENCE AND ENGINEERING**		
ACADEMIC UNIT	**MATERIALS SCIENCE AND TECHNOLOGY**		
LEVEL OF STUDIES	**POSTGRADUATE**		
COURSE CODE	**TAO - 103**	**SEMESTER**	**1**
COURSE TITLE	**WAVES AND TISSUE**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.
Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, students will be able to:

- Know the basic principles governing wave propagation in homogeneous and heterogeneous media.
- Know the basic principles and methods of wave generation and detection
- Know the techniques that allow us to control the deposition of wave energy from the source to the target

- Know the basic principles governing the interaction of waves with tissue and have first contact with their applications in medicine.
- Get to know the principles of operation of imaging optical systems.
- To be able to autonomously describe and solve wave propagation problems

The course according to the European Qualifications Framework for Lifelong Learning belongs to level 7.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations Decision-making	*Respect for difference and multiculturalism*
Working independently Teamwork	*Respect for the natural environment*
Working in an international environment	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Working in an interdisciplinary environment Production of new research ideas	*Criticism and self-criticism*
	Production of free, creative and inductive thinking .....
	Others...
	.....

- Capacity to address complex problems.
- Development of scientific thought
- Use of the University Library and multiple bibliographic references
- Searching sources, simulations, and electronic courses on the internet
- Taking notes and development of independent methods of studying
- Writing research reports
- Efficient management of time and deadlines
- Development of the ability to present concepts in a succinct form

(3) SYLLABUS

2) Fundamentals

Waves (elastic/sound, E/M radiation), *Longitudinal/Transverse (Polarization), Wave superposition*

a) **Sources of radiation**

Incoherent: Black body radiation, incandescent, arc, spectral gas, fluorescence lamps, LEDs, *X-rays*

Coherent/ Partially Coherent: Lasers (Continuous -Pulsed), Laser Types - Medical lasers*, Ultrasound*

b) **Detection of Radiation**

The photoelectric effect, photomultipliers, photoresistors, photodiodes, phototransistors, CDD detectors, film, Photometry – Radiometry, Radiant- Luminus flux, intensity, emittance. Illumination - Irradiance

3) Energy Delivery

Homogeneous/inhomogeneous media, *Absorption, Scattering*
Basic principles of wave propagation: *Diffraction, Abberations*
Energy delivery Systems
Optical Systems

Geometrical Optics: Lenses-Mirrors, simple optical systems, Aberrations
Structured waves: Wavefront sensing, Adaptive optics, Wavefront shaping, SLMs
Wave propagation in inhomogeneous/turbid media: Radiative transport equation, Diffusion theory, Transport mean free path

4) Wave-tissue interaction

Fundamentals of wave matter interaction

Electronic states, Jablonski diagram, Radiative and non-radiative transitions, Fluorescence, phosphorescence, Absorption, single vs multi-photon, Absorption spectrum, The effect of pulse duration, Thermal, non-thermal, and combined thermal and non-thermal effects, Temporal dynamics

Sub threshold processes**:**

Photodynamic therapy (PDT), Photothermal therapy (PTT)

Destructive processes:

Surgery, Dental lasers, Lasers in Ophthalmology, Ultrasound

(4) TEACHING and LEARNING METHODS - EVALUATION

Delivery *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of slides • Videos with demonstration/understanding experiments. • Use of Demonstration experiments • Use of an asynchronous e-learning platform (e-class) where the following are provided: o *Bibliography of the course* *o Slides of the course* *o Solved and unsolved exercises* *o Self-study Exercise Set* *o Lecture videos*[*] *o Demonstration videos and simulations* *o* Communication through the e-class platform, use of the discussion area facility with topics, email as well as fixed office hours announced • Students' assignments are received and corrected via the platform (e-class)
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching,*	

Activity	***Semester workload***
Lectures	52
Assignments/Projects	30
Directed learning activity (office hours)	26
Non-directed learning activity	66
Course total	***174***

educational visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	<table><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically defined evaluation criteria are given, and if and where they are accessible to students.*	Language of Evaluation: English The final grade is the sum of 40% of the average of the grades of the weekly assignments 30% of the average of the grades of the weekly written tests 30% of the grade of the final written examination

(5) ATTACHED BIBLIOGRAPHY

Bibliography-

- *Lecture notes*
- *"Optics", E. Hecht, Addison-Wesley, (2001).*
- *“Laser-Tissue Interactions”, by Markolf H. Niemz (Springer International Publishing), 4th Edition (2019)*
- *Introduction to Modern Optics, by Grant R. Fowles (Dover Books on Physics) 2nd ed. Edition,*

Bibliography: exercises with solutions

- *Solved exercises in Waves and Tissue interactions”, D. Papazoglou, UoC, (2024).*

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
ACADEMIC UNIT			
LEVEL OF STUDIES	**POSTGRADUATE**		
COURSE CODE	**TAO - 104**	**SEMESTER**	**1**
COURSE TITLE	**BIOLOGY**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.
Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, students will be able to:

- Know

The course according to the European Qualifications Framework for Lifelong Learning belongs to level 7.

General Competences *Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?*	
Search for, analysis and synthesis of data and information, with the use of the necessary technology *Adapting to new situations Decision-making* *Working independently Teamwork* *Working in an international environment* *Working in an interdisciplinary environment Production of new research ideas*	*Project planning and management* *Respect for difference and multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking .....* *Others...* *.....*
• Capacity to address complex problems. • Development of scientific thought • Use of the University Library and multiple bibliographic references • Searching sources, simulations, and electronic courses on the internet • Taking notes and development of independent methods of studying • Writing research reports • Efficient management of time and deadlines • Development of the ability to present concepts in a succinct form	

(3) SYLLABUS

Fundamentals

(4) TEACHING and LEARNING METHODS - EVALUATION

Delivery *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of slides • Videos with demonstration/understanding experiments. • Use of an asynchronous e-learning platform (e-learn) where the following are provided: o *Bibliography of the course* *o Slides of the course* *o Self-study Exercise Set* *o Lecture videos* *o Demonstration videos and simulations* *o* Communication through the e-learn platform, use of the discussion area facility with topics, email as well as fixed office hours announced

<table>
<tr><td></td><td>• Students' assignments are received and corrected via the platform (e-learn)</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Assignments/Projects</td><td></td></tr>
<tr><td>Directed learning activity (office hours)</td><td></td></tr>
<tr><td>Non-directed learning activity</td><td>125 (3 hours study/course during the semester and 2 hours study /course as preparation for the final exam)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>175</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Language of Evaluation: English

The final grade is calculated from the final written examination grade (100%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Bibliography

- *Lecture notes*

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
DEPARTMENT			
LEVEL OF STUDY	**POSTGRADUADE**		
COURSE CODE	**TAO - 105**	**SEMESTER OF STUDY**	**1**
COURSE TITLE	**MINI REVIEW PROJECTS**		
INDEPENDENT TEACHING ACTIVITIES		**TEACHING WEEKS**	**CREDITS**
			2
COURSE TYPE	Specific background, specialization, general knowledge, skills development		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION AND EXAMINATIONS:	English		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)			

(2) LEARNING OUTCOMES

Learning Outcomes
Upon successful completion of the course, students will: • *They have developed the necessary skills and competencies to conduct research: understanding and presenting scientific articles, writing a literature review, cultivating scientific judgment, formulating research hypotheses and checking their correctness.* • *They have built a solid foundation of prior knowledge of the field* • *They are able to identify recent developments in the field and evaluate the relevance of a publication and the reliability of the results presented* • *Understand the state of science and open questions in the field*
General Competencies
• *Troubleshoot complex problems* • *Development of scientific thinking* • *Use of the university library and multiple bibliographic sources* • *Management of time and deadlines* • *Development of the ability to summarize concepts* • *Teamwork*

(3) COURSE CONTENT

A/A		
1	The method	
2	Presentation / publication of results	
3	Bibliographic search - Endnote	
4	Types of studies and sample size selection	
5	Sensitivity, specificity and ROC curves	
6	Reliability & method comparison studies	
	The Journal Club **Students' Mini-projects (8-10)**	
7	Student Project	
7	Student Project	
9	Student Project	
10	Student Project	
11	Student Project	

(4) TEACHING AND LEARNING METHODS - ASSESSMENT

DELIVERY METHOD	Face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	All available and appropriate ways
TEACHING ORGANIZATION	***Activity*** / ***Semester Workload (hours)***
	Lectures: 12
	Literature study & analysis: 18
	Guided Study: 5
	Unguided Study: 15
	Total Course: **50**
STUDENT EVALUATION	Assessment language: English Presentation of the Literature Review and Master's Plan

(5) RECOMMENDED-BIBLIOGRAPHY

- Notes
- Dependent on the scope of the project

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
SECTION			
LEVEL OF STUDY	**POSTGRADUATE**		
COURSE CODE	**TAO - 201**	**SEMESTER OF STUDY**	**2**
COURSE TITLE	**EYE AND VISION II**		

INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded to distinct parts of the course e.g. lectures, laboratory exercises, etc. If the credits are awarded uniformly for the entire course, indicate the weekly teaching hours and the total credits*	**TEACHING WEEKS**	**CREDITS**
Lectures	4	6
Add rows if needed. The teaching organization and teaching methods used are described in detail in (d).		

COURSE TYPE *general background, specific background, specialization, general knowledge, skills development*	General background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION AND EXAMINATIONS:	English
THE COURSE IS OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning Outcomes *The learning outcomes of the course are described, the specific knowledge, skills and competences of an appropriate level that students will acquire after the successful completion of the course.* *Consult Appendix A* • *Description of the Level of Learning Outcomes for each cycle of study according to the Qualifications Framework of the European Higher Education Area* • *Descriptors of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B* • *Learning Outcomes Writing Summary Guide*
Upon successful completion of the course, students will be able to: • Understand the pathophysiology of the human eye and know basic approaches to diagnosis and treatment of eye and vision problems • Know the main intraocular neoplasias and how they are treated

- Know basic concepts of pharmacology and their applications in eye diseases
- Understand different ways of assessing visual function
- Be able to autonomously describe and resolve complex questions related to the above issues.

The course according to the European Lifelong Learning Qualifications Framework is level 7 as a second cycle course.

General Competencies

Taking into account the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and listed below), which of them does the course aim at?.

Search, analyze and synthesize data and information, using the necessary technologies	*Project planning and management*
Adapting to new situations	*Respect for diversity and multiculturalism*
Decision-making	*Respect for the natural environment*
Autonomous work	*Demonstrate social, professional and ethical responsibility and sensitivity to gender issues*
Teamwork	*Criticism and self-criticism*
Working in an international environment	*Promoting free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Generation of new research ideas	*Other...*
	…….

- Troubleshoot complex problems
- Development of scientific thinking
- Use of the university library and multiple bibliographic sources
- Search resources, simulations and online courses
- Create notes and autonomous study method
- Implementation of research projects
- Management of time and deadlines
- Development of the ability to summarize concepts

(3) COURSE CONTENT

1. **Pathophysiology of the eye**

   Common eye diseases: Diseases of the anterior half of the eye (diseases of the eyelids, cornea, lens, iris, ciliary body and refractive abnormalities), diseases of the posterior half of the eye (diseases of the vitreous, retina, choroid/uvea and genetically inherited diseases), systemic diseases with significant ophthalmological alterations and genetically inherited diseases, diseases of the optic nerve and optic tract. Basic principles of ophthalmic surgery for the treatment of diseases of the anterior and posterior segment.

2. **Neoplasms of the eye and basic principles of radiotherapy**

   Intraocular neoplasms, types of neoplasms and categorization. Imaging, diagnosis and modern therapeutic approaches. Choroidal melanoma: Pathophysiology/histology, differential diagnosis and treatment methods. Definition of radiobiology/radiotherapy. Interaction of ionizing radiation with biological targets. Procedure and applications in the performance of radiotherapy for intraocular tumors with emphasis on choroidal melanoma.

3. **Basic principles of pharmacology, ophthalmic therapeutics and surgery**
   Introduction to pharmacology and drug classes. Pharmacokinetics/pharmacodynamics. Classes of drugs and how they work in eye diseases. Development of new drugs for the treatment of eye diseases and modern challenges in intraocular pharmacokinetics/pharmacodynamics. Modern challenges in intraocular drug administration.

4. **Visual function assessment methods**
   Introduction to refraction and optotypes. Visual fields, color vision test, electrophysiological control of retinal function and visual pathway, psychophysical tests to assess visual function

(4) TEACHING AND LEARNING METHODS - ASSESSMENT

<table>
<tr><td>DELIVERY
METHOD Face to face, Distance learning, etc.</td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
Use of ICT in Teaching, Laboratory Training, Communication with students</td><td>• Use slides
• View videos with demonstration and/or comprehension experiments.
• Use of an asynchronous e-learning platform where the following are provided:
  ○ Bibliography of the course
  ○ Slides of the course
  ○ Self-study question quiz
  ○ Lecture videos
• Communication through the e-learn platform, use of the possibility of discussion space with topics, emails as well as fixed office hours that have been announced</td></tr>
<tr><td>TEACHING ORGANIZATION
The method and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography Study & Analysis, Tutorial, Internship (Placement), Clinical Practicing, Art Workshop, Interactive Teaching, Educational visits, Project Writing, Writing a project / assignments, Artistic creation, etc.

The student's study hours for each learning activity as well as the hours of unguided study according to ECTS principles are listed</td><td>
<table>
<tr><th>Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>36 (18 x 2)</td></tr>
<tr><td>Tasks/Project</td><td>20</td></tr>
<tr><td>Guided Study (office hours)</td><td></td></tr>
<tr><td>The Unguided Study</td><td>90 (3 hours study/lecture during the semester and 2 hours study/lecture revision for the final exams)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Total Course</td><td>146</td></tr>
</table>
</td></tr>
<tr><td></td><td></td></tr>
</table>

STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Summative, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay/Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination of a Patient, Artistic Interpretation, Other/Others* *Explicitly defined evaluation criteria and whether and where they are accessible to students are mentioned.*	Assessment language: English The final grade is derived from the grade of the final written examination (100%).

(5) RECOMMENDED-BIBLIOGRAPHY

Bibliography

- Course presentations
- **Ophthalmology: An Illustrated Colour Text 4th Edition** by Mark Batterbury Bsc FRCS FRCOphth and Conor Murphy MMedSc FRCSI FRCOphth PhD

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
DEPARTMENT			
LEVEL OF STUDY	**POSTGRADUATE**		
COURSE CODE	**TAO - 202**	**SEMESTER OF STUDY**	**2**
COURSE TITLE	**BIOSTATISTICS**		

INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded to distinct parts of the course e.g. lectures, laboratory exercises, etc. If the credits are awarded uniformly for the entire course, indicate the weekly teaching hours and the total credits*	**TEACHING WEEKS**	**CREDITS**
	2	6
Add rows if needed. The teaching organization and teaching methods used are described in detail in (d).		

COURSE TYPE *general background, specific background, specialization, general knowledge, skills development*	GENERAL BACKGROUND
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION AND EXAMINATIONS:	ENGLISH
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course are described, the specific knowledge, skills and competences of an appropriate level that students will acquire after the successful completion of the course.

Consult Appendix A

- *Description of the Level of Learning Outcomes for each cycle of study according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Learning Outcomes Writing Summary Guide*

- The acquisition of solid knowledge of statistical concepts and methods widely used in biomedical research and in the field of Vision Sciences.
- The ability to interpret the results of statistical analyses as well as the documented critical evaluation of the statistical methodology of biomedical publications.

- The acquisition of fluency in the use of the SPSS statistical package for the statistical processing of research data.

General Competencies

Taking into account the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and listed below), which of them does the course aim at?.

Search, analyze and synthesize data and information, using the necessary technologies	*Project planning and management*
Adapting to new situations	*Respect for diversity and multiculturalism*
Decision-making	*Respect for the natural environment*
Autonomous work	*Demonstrate social, professional and ethical responsibility and sensitivity to gender issues*
Teamwork	*Criticism and self-criticism*
Working in an international environment	*Promoting free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Generation of new research ideas	*Other...*
	…….

What skills should the graduate have acquired at the end of the course:

- Briefly describe a dataset with appropriate numerical measures.
- To present data and research results with appropriate tables and diagrams.
- Prepare, organize and manage spreadsheets and data files in statistical packages.
- Use basic statistical inference tools (confidence intervals and p-values) as indicators of uncertainty of research results.
- To select and apply statistical significance tests appropriate to the data under study and in relation to the research questions of the study.
- Select and use appropriate correlation measures of two variables.
- Distinguish between statistical and clinical significance.
- Critically evaluate statistical methodology and the results of published research papers.

(3) COURSE CONTENT

Course content:

- Introduction - Why we need to know basic principles of Biostatistics
- Descriptive Statistics I: Tables of distributions, graphs, morphology of distributions, normal distribution.
- Descriptive Statistics II: Central trend indices, dispersion indices, reference ranges of normal values, Z-scores, tables of probability of typical normal distribution.
- Introduction to statistical inference and inferential statistics: Sample variability, Standard error, Confidence interval, Null hypothesis, p-values, Statistical significance, Clinical significance.
- Introduction to the SPSS statistical data processing and analysis package.
- Hypothesis Tests for Population Mean Values: Basic stages of hypothesis testing, types of errors, validity, t-test in dependent and independent samples, non-parametric Wilcoxonsignedtest, Mann-Whitney U test.
- Linear Correlation & Regression in Bivariate Data.
- Techniques for analyzing qualitative variables. Relative risk, oddsratio. Hi-squared controls and McNemar. Evaluation of diagnostic tests: sensitivity, specificity, positive and negative predictive value.

Published papers to be used as exercises in teaching the course:

- Numerous examples from published biomedical studies are used to highlight the statistical ideas, concepts and methods addressed by the course.

- Data files (or subsets thereof) from faculty research studies are used for the practical part of the course using the SPSS package software.

(4) TEACHING AND LEARNING METHODS - ASSESSMENT

<table>
<tr><td>DELIVERY
METHOD Face to face, Distance learning, etc.</td><td>FACE TO FACE</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
Use of ICT in Teaching, Laboratory Training, Communication with students</td><td>SUPPORT OF THE LEARNING PROCESS THROUGH THE E-LEARN PLATFORM</td></tr>
<tr><td>TEACHING ORGANIZATION
The method and methods of teaching are described in detail.
Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography Study & Analysis, Tutorial, Internship (Placement), Clinical Practicing, Art Workshop, Interactive Teaching, Educational visits, Project Writing, Writing a project / assignments, Artistic creation, etc.

The student's study hours for each learning activity as well as the hours of unguided study according to ECTS principles are listed</td><td>
<table>
<tr><th>Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures and seminars</td><td>30</td></tr>
<tr><td>Non-guided study of teaching materials (slides, videos, applets), and recommended literature</td><td>90</td></tr>
<tr><td>Solving exercises, including self-assessment tests and basic statistical software use exercises.</td><td>50</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total:</td><td>170</td></tr>
</table>
</td></tr>
<tr><td>STUDENT EVALUATION
Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Summative, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay/Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination of a Patient, Artistic Interpretation, Other/Others</td><td>

Self-assessment online quizzes with feedback are available to students per module of the course on the elearn online asynchronous training platform of the University of Crete.
The final grade in the course results entirely from a written examination at the end of the semester. The written final exam includes multiple choice, correct error, and short answer questions, including short computational questions.
Students are assessed on their proven ability to understand the course content as a whole and adapt it to specific cases or scenarios of research studies to solve problems. Students must demonstrate their ability to use, apply and interpret, critically, the bio-statistical

</td></tr>
</table>

Explicitly defined evaluation criteria and whether and where they are accessible to students are mentioned.	concepts, techniques and methods addressed in the course.

(5) RECOMMENDED BIBLIOGRAPHY

1. *Practical Statistics for Medical Research* D.G. Altman, 1991 (links to buy: Public, Amazon)
2. *Medical Statistics A Textbook for the Health Sciences*5th ed. D. Machin, MJ Campbell & Walters, 2021 (link to buy:Amazon,Vasiliadis,Hypokratis)
3. Medical Statistics from Scratch, 4th ed., D. Bowers, 2020 (link to buy:Amazon,Vasiliadis)

Related scientific journals and articles:
Important scientific articles, reviews and book chapters posted on the course website in e-learn or given in the course.

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCE AND ENGINEERING		
ACADEMIC UNIT	MATERIALS SCIENCE AND TECHNOLOGY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**TAO -203**	**SEMESTER**	**2**
COURSE TITLE	**PRINCIPLES OF IMAGING**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.
Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, students will be able to:
• Know the basic theoretical principles governing the detection, analysis and creation of an image using electromagnetic radiation.
• Know the basic principles of image reconstruction using inverse problems
• Know the basic operating principles of optical microscopic imaging methods
• Know the basic operating principles of optical macroscopic imaging methods
• Know the basic operating principles of medical imaging methods

- Be able to independently describe and solve imaging problems

The course according to the European Qualifications Framework for Lifelong Learning belongs to level 7.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations Decision-making	*Respect for difference and multiculturalism*
Working independently Teamwork	*Respect for the natural environment*
Working in an international environment	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Working in an interdisciplinary environment Production of new research ideas	*Criticism and self-criticism*
	Production of free, creative and inductive thinking .....
	Others...
	.....

- Capacity to address complex problems.
- Development of scientific thought
- Use of the University Library and multiple bibliographic references
- Searching sources, simulations, and electronic courses on the internet
- Taking notes and development of independent methods of studying
- Writing research reports
- Efficient management of time and deadlines
- Development of the ability to present concepts in a succinct form

(3) SYLLABUS

1) Theoretical foundations of Imaging

Introduction

a) Basic concepts
b) Image acquisition
c) Image processing
d) Image reconstruction
    a. Forward problem
    b. Inverse problem
        i. Back projection
        ii. Iterative method
e) Image registration/fusion

2) Wave Metrology

a) Components of wave metrology systems
i) Radiation Input
ii) Interaction/transformation
iii) Imaging system
iv) Detection

3) Applications

a) Microscopy

(1) Basic concepts

i. Types of microscopy

- Bright field, Phase contrast
- Fluorescence
- Confocal
- Non-linear
  - Multiphoton, Harmonic generation, Raman
- Super resolution
  - SIM, STED, PALM/STORM
- Light-sheet
- Photoacoustic
  - *Optical and acoustic resolution*

b) Macroscopic imaging

- Optical projection tomography (OPT)
- Optical coherence tomography (OCT)
- Diffuse fluorescence
- Bioluminescence
- Photoacoustic tomography
- Image guided surgery

c) Ultrasound

d) X-Ray Computed Tomography (X-Ray CT)

e) MRI

f) Nuclear imaging

(4) TEACHING and LEARNING METHODS - EVALUATION

Delivery *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of slides • Videos with demonstration/understanding experiments. • Use of Demonstration experiments • Use of an asynchronous e-learning platform (e-class) where the following are provided: o *Bibliography of the course* *o Slides of the course* *o Solved and unsolved exercises* *o Self-study Exercise Set* *o Demonstration videos and simulations* *o* Communication through the e-class platform, use of the discussion area facility with topics, email as well as fixed office hours announced

<table>
<tr><td></td><td>• Students' assignments are received and corrected via the platform (e-class)</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Assignments/Projects</td><td>50</td></tr>
<tr><td>Directed learning activity (office hours)</td><td>26</td></tr>
<tr><td>Non-directed learning activity</td><td>35</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>150</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Language of Evaluation: English

The final grade is the sum of
30% of the grade of a written report and public presentation for an assignment
70% of the grade of the final written examination</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Bibliography

- *Lecture notes*
- *Lecture slides with explanatory text*
- *" Introduction to Biomedical Imaging, 2nd Edition ", by A. Webb, Wiley-IEEE Press, (2022)*
- *“Essentials of In Vivo Biomedical Imaging”, by S. R. Cherry, R. D. Badawi, J. Qi, CRC Press, (2015)*

- *"Introductory Biomedical Imaging: Principles and Practice from Microscopy to MRI", by B. A. Scalettar, J. R. Abney, CRC Press (2023)*

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE AND SCIENCES AND TECHNOLOGY**		
ACADEMIC UNIT	**MEDICINE, MATERIALS MECHANICS AND TECHNOLOGY, MATHEMATICS AND APPLIED MATHEMATICS**		
LEVEL OF STUDIES	**POSTGRADUATE**		
COURSE CODE	**TAO - 204**	**SEMESTER**	**2**
COURSE TITLE	**MATHEMATICS II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	general background		
PREREQUISITE COURSES	None		
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English		
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)			

(2) LEARNING OUTCOMES

Learning outcomes *The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.* *Consult Appendix A* • *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area* • *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B* • *Guidelines for writing Learning Outcomes*
Upon successful completion of the course, students will be able to: • be able to formulate mathematical modeling problems related to optics and vision technologies and related areas from the medical sciences. • understand the procedures for solving these problems and the appropriate tools-methods required.

- be able to solve simple mathematical modeling problems that use differential equations.
- evaluate the solutions of these problems.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations Decision-making	*Respect for difference and multiculturalism*
Working independently Teamwork	*Respect for the natural environment*
Working in an international environment	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Working in an interdisciplinary environment Production of new research ideas	*Criticism and self-criticism*
	Production of free, creative and inductive thinking .....
	Others...
	.....

- Capacity to formulate and solve complex problems of mathematical modelling.
- Development of analytical multi-level thinking.
- Work in a interdisciplinary environment.
- Promotion of creative and inductive thinking.
- Use of the University Library and multiple bibliographic references
- Search for sources, simulations, and electronic courses on the internet
- Search for packages to solve selected problems from the web.
- Autonomous and teamwork.

(3) SYLLABUS

1. **FUNDAMENTAL ORDINARY DIFFERENTIAL EQUATIONS & ELEMENTARY DYNAMICAL SYSTEMS**
   - 1.1. The concept of differential equation
   - 1.2. Autonomous differential equations
   - 1.3. Separable differential equations & solving by integration
   - 1.4. Balance & stability of solutions
   - 1.5. Modeling with differential equations
     - 1.5.1. Diffusion models of energy, drugs, etc.
     - 1.5.2. Models of chemical reactions
     - 1.5.3. Epidemiology models

2. FUNCTIONS OF SEVERABLE VARIABLES

- 2.1. Definition of the function of several variables
- 2.2. Graphing functions of several variables
- 2.3. Color representations and isosceles curves
- 2.4. Partial derivatives (heuristic definition & calculations)
- 2.5. Directional derivative & basic vector operators
- 2.6. Maxima & minima of functions of several variables
- 2.7. The method of least squares
- 2.8. Integrals of functions of several variables

3. **INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS** 3.1. The concept of partial differential equation 3.2. The diffusion equation. Fick's Law. 3.3. The wave equation

(4) TEACHING and LEARNING METHODS - EVALUATION

Delivery *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of slides • Use of an asynchronous e-learning platform (e-class) where the following are provided: o *Bibliography of the course* *o Slides of the course* *o Solved and unsolved exercises* *o* Communication through the e-class platform, use of the discussion area facility with topics, email as well as fixed office hours announced.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	

Activity	***Semester workload***
Lectures	52
Assignments/Projects	30
Directed learning activity (office hours)	26
Non-directed learning activity	66
Course total	***174***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory*	Language of Evaluation: English The final grade is the sum of 30% of a progress compulsory examination 70 % of the final written examination If the final exam grade is higher than the progress grade, the final grade is that of the final written exam.

work, clinical examination of patient, art interpretation, other *Specifically defined evaluation criteria are given, and if and where they are accessible to students.*	

(5) SUGGESTED BIBLIOGRAPHY

Bibliography

- C.Neuhauser & M. Ropper, Calculus for Biology and Medicine, 4th edition, Pearson, 2018
- J.R. Hass, C. Heil & M D. Weir, Thomas' Calculus in SI Units, Pearson, 2019

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
ACADEMIC UNIT			
LEVEL OF STUDIES	**POSTGRADUATE**		
COURSE CODE	**TAO - 205**	**SEMESTER**	**2**
COURSE TITLE	**VISUAL OPTICS**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	special background
PREREQUISITE COURSES	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS	English
IS THIS COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.
Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, students can understand :
The basic principles if physiological optics
Visual acuity, contrast sensitivity, refraction, types of ametropia binocurality , stereopsis and how to evaluate them.
Assessment of corneal curvature and wavefront aberrations and their contribution in vision.
Optical coherence tomography

Magnifying apparatus (slit -lamp, microscopy, direct and indirect ophthalmoscopy) and their role in visual assessment.
Visual Field tests
Visual Psychophysics
Electrophysiological examination of vison

The course according to the European Qualifications Framework for Lifelong Learning belongs to level 7.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations Decision-making	*Respect for difference and multiculturalism*
Working independently Teamwork	*Respect for the natural environment*
Working in an international environment	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Working in an interdisciplinary environment Production of new research ideas	*Criticism and self-criticism*
	Production of free, creative and inductive thinking .....
	Others...
	.....

(3) SYLLABUS

- Introduction in basic principles of Physiological optics
- Interference, Refraction, Diffraction
- Resolution of the human eye, Visual acuity
- Assessment of the visual acuity
- Contrast Sensitivity in visual function evaluation
- Binocularity, Stereopsis
- Corneal curvature, topography and tomography maps of the eye
- Wavefront analysis of the eye
- Visual function and wavefront aberrations
- Visual fields
- Optical Coherence Tomography
- Visual Psychophysics
- Electrophysiological examination of vison
- Magnifying apparatus (slit-lamp, microscopy, direct and indirect ophthalmoscopy) and their role in eye assessment)
- Fundus camera
- Tonometry

(4) TEACHING and LEARNING METHODS - EVALUATION

Delivery *Face-to-face, Distance learning, etc.*	Face-to-face

<table>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY Use of ICT in teaching, laboratory education, communication with students</td><td>

Use of slides
Videos with demonstration/understanding experiments.
Use of Demonstration experiments
Use of an asynchronous e-learning platform (e-class) where the following are provided:
o Bibliography of the course
o Slides of the course
o Solved and unsolved exercises
o Self-study Exercise Set
o Lecture videos*
o Demonstration videos and simulations
o Communication through the e-class platform, use of the discussion area facility with topics, email as well as fixed office hours announced
Students' assignments are received and corrected via the platform (e-class)

</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>44</td></tr>
<tr><td>Assignments/Projects</td><td>22</td></tr>
<tr><td>Directed learning activity (office hours)</td><td>22</td></tr>
<tr><td>Non-directed learning activity</td><td>90</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>178</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory</td><td>Language of Evaluation: English

The final grade is the sum of

Final written examination grade: 80%

Assignments grade : 20%</td></tr>
</table>

work, clinical examination of patient, art interpretation, other *Specifically defined evaluation criteria are given, and if and where they are accessible to students.*	

(5) ATTACHED BIBLIOGRAPHY

Bibliography-

- R. Rabbett. Bennett and Rabbett's clinical visual optics. Butterworth Heinemann
- R. Gregory. Eye and Brain: The psychology of Seeing. Oxford University Press
- Physiological Optics Martin Juttner, Neuroscience Research Institute, School of Life & Health Sciences, Aston University.

COURSE OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
DEPARTMENT			
LEVEL OF STUDY	**POSTGRADUATE**		
COURSE CODE	**TAO - 301**	**SEMESTER OF STUDY**	**3**
COURSE TITLE	**INTERDISCIPLINARY MODULES**		

INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded to distinct parts of the course e.g. lectures, laboratory exercises, etc. If the credits are awarded uniformly for the entire course, indicate the weekly teaching hours and the total credits*	**TEACHING WEEKS**	**CREDITS**
Lectures	20	30
Add rows if needed. The teaching organization and teaching methods used are described in detail in (d).		

COURSE TYPE *general background, specific background, specialization, general knowledge, skills development*	Special background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION AND EXAMINATIONS:	English
THE COURSE IS OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course are described, the specific knowledge, skills and competences of an appropriate level that students will acquire after the successful completion of the course.

Consult Appendix A

- *Description of the Level of Learning Outcomes for each cycle of study according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Learning Outcomes Writing Summary Guide*

Upon successful completion of the course, students will be able to:

- Know the basic principles governing the subjects of the modules they will choose.
- Be familiar with the interdisciplinary nature of the topics to be addressed.

- To discuss and work on issues the management of which requires knowledge and skills of more than one subject
- Be able to autonomously describe and solve problems in cutting-edge areas of perspective that require an interdisciplinary approach

The course according to the European Lifelong Learning Qualifications Framework is level 7 as a second cycle course.

General Competencies

Taking into account the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and listed below), which of them does the course aim at?.

Search, analyze and synthesize data and information, using the necessary technologies	*Project planning and management*
Adapting to new situations	*Respect for diversity and multiculturalism*
Decision-making	*Respect for the natural environment*
Autonomous work	*Demonstrate social, professional and ethical responsibility and sensitivity to gender issues*
Teamwork	*Criticism and self-criticism*
Working in an international environment	*Promoting free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Generation of new research ideas	*Other...*
	…….

- Addressing complex cross-disciplinary visual problems
- Collaboration with scientists in more than one discipline to solve problems
- Development of interdisciplinary thinking
- Use of the university library and multiple bibliographic sources
- Search resources, simulations and online courses
- Create notes and autonomous study method
- Implementation of research projects
- Management of time and deadlines
- Development of the ability to summarize concepts

(3) COURSE CONTENT

Each student is asked to choose 4 modules from the following offered:

Section 1: Monitoring the signal in the optical pathway: from photons to vision

Module that aims to understand and familiarize with the neurophysiology of vision and the technologies that support it. Collaborate Medical School UC, FORTH.

Section 2: Refractive errors: correction by interfering with the visual elements of the eye
Module aimed at understanding and familiarizing with the use of physiological optics and related technologies for the therapeutic modification of the visual properties of the eye. Collaborating Medical School of UC, FORTH, DMSE.

Section 3: Slow release of drugs for ophthalmological use

Module aimed at understanding and familiarization with Ophthalmic pharmacology and techniques that allow development of slow-release drugs. Collaborate Medical School of UC, DMSE.

4th session: New technologies in ophthalmic oncology

Module aimed at understanding and familiarizing with the applications of radiation physics in ophthalmic oncology. Collaborate Medical School UC, FORTH, MUC.

5th session: New ophthalmic imaging technologies Module that aims to understand and familiarize with modern imaging technologies with application in ophthalmology and vision sciences. Collaborating Medical School of UC, FORTH, DMSE. Each module includes lectures, participation in exercises and project presentation.

(4) TEACHING AND LEARNING METHODS - ASSESSMENT

<table>
<tr><td>DELIVERY
METHOD Face to face, Distance learning, etc.</td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
Use of ICT in Teaching, Laboratory Training, Communication with students</td><td>• Use slides
• View videos with demonstration and/or comprehension experiments.
• Use of an asynchronous e-learning platform where the following are provided:
  ○ Bibliography of the course
  ○ Slides of the course
  ○ Self-study question quiz
  ○ Lecture videos
• Communication through the e-learn platform, use of the possibility of discussion space with topics, emails as well as fixed office hours that have been announced</td></tr>
<tr><td>TEACHING ORGANIZATION
The method and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography Study & Analysis, Tutorial, Internship (Placement), Clinical Practicing, Art Workshop, Interactive Teaching, Educational visits, Project Writing, Writing a project / assignments, Artistic creation, etc.

The student's study hours for each learning activity as well as the hours of unguided study according to ECTS principles are listed</td><td>
<table>
<tr><th>Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>200</td></tr>
<tr><td>Tasks/Project</td><td>120</td></tr>
<tr><td>Guided Study (office hours)</td><td>100</td></tr>
<tr><td>The Unguided Study</td><td>240</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Total Course</td><td>700</td></tr>
</table>
</td></tr>
<tr><td>STUDENT EVALUATION
Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Summative, Multiple Choice</td><td>Assessment language: English
The final grade results from

The grade of the final exam: 80%

The grade of work: 20%</td></tr>
</table>

Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay/Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination of a Patient, Artistic Interpretation, Other/Others *Explicitly defined evaluation criteria and whether and where they are accessible to students are mentioned.*	

(5) RECOMMENDED-BIBLIOGRAPHY

Bibliography • *Depending on the content of the interdisciplinary modules*

MASTER THESIS OUTLINE

(1) GENERAL

SCHOOL	**of MEDICINE**		
DEPARTMENT			
LEVEL OF STUDIES	**POSTGRADUATE**		
COURSE CODE	**TAO - 401**	**SEMESTER OF STUDY**	**4**
COURSE TITLE	**MASTER'S THESIS**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDIT UNITS**
			30
TYPE OF *COURSE*	Specific background, specialisation, general knowledge, skills development		
PREREQUISITE COURSES:	-		
LANGUAGE OF TEACHING AND EXAMINATION:	English		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO		
ELECTRONIC COURSE PAGE (URL)			

(2) LEARNING OUTCOMES

Learning Outcomes
Upon successful completion of the course, students will: • *Have built up a solid background of prior knowledge in the field of vision sciences* • *They have broadened the knowledge of their undergraduate studies to include new subjects that allow them to understand and deepen their understanding of the interdisciplinary field of vision sciences* • *Have acquired expertise (theoretical knowledge and specialised skills) in the areas of specialisation of the postgraduate thesis.* • *They have learned how to conduct research, the relevant ethical issues, how to make presentations and will have gained information on relevant research direction and cutting-edge research* • *They have developed the skills and competences necessary for conducting research: understanding and presenting scientific articles, writing a literature review, developing scientific judgement, formulating research hypotheses and checking their validity.* • *They have cultivated their ability to work in interdisciplinary teams focused on cutting-edge vision technologies, through participation in collaborative research and development projects with industry or academia.* • *Have learned to apply their knowledge to solve practical problems*
General skills
• *Interdisciplinary broadening of knowledge* • *Dealing with complex problems* • *Development of scientific thinking* • *Decision-making* • *Adapting to new situations, exposure to international environment* • *Autonomous work*

- *Management of time and deadlines*
- *Developing the ability to summarise concepts*
- *Teamwork*

(3) COURSE CONTENT

Dependent on the subject of the postgraduate thesis

(4) TEACHING and LEARNING METHODS - EVALUATION

METHOD OF DELIVERY	Face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	All available and tested ways
ORGANISATION OF TEACHING	

Activity	***Semester workload (hours)***
Designing the research project, conducting experiments, completing the analysis of the results, drawing the final conclusions.	70
Guided Study	30
Postgraduate Thesis Writing	150
Total Course	**250**

STUDENT ASSESSMENT	Language of Evaluation: English The student presents publicly before the examination board. The Master's thesis is examined by the examination committee in accordance with the applicable provisions and includes oral support of the thesis before an audience at a date and time determined by the examination committee. After the presentation - support of the Master's thesis, the three-member Examination Committee draws up and signs a record of the public presentation of the Master's thesis in which any comments or remarks as well as the final evaluation of the thesis are recorded. The text submitted by the student must meet the requirements and structure of a scientific paper, i.e. it must include a description of the topic of the thesis, an introductory part with a brief review of the field and a description of the research question, methodology, research results and findings of the study, discussion of the results, bibliography and any other necessary supporting or explanatory elements (necessary figures, diagrams, photographs, images, etc.). It shall be written in English and accompanied by a short abstract of approximately 300 words in both Greek and English. In the first few pages of the thesis, the PS must state that the thesis is not plagiarised, either in whole or in part. No grading is foreseen for the Master's thesis. The evaluation of the Master's thesis is done according to the pass/fail scale.

	If the thesis is considered unsatisfactory by the committee, the committee may ask the graduate student to improve it, to modify certain parts of it, or to radically reform it. The committee shall set a specific time frame within which the thesis must be resubmitted modified in accordance with its recommendations.

(5) RECOMMENDED-BIBLIOGRAPHY

- Dependent on the subject of the postgraduate *thesis*