COURSE OUTLINE

GENERAL

SCHOOL	Sciences and Engineering		
ACADEMIC UNIT	Computer Science		
LEVEL OF STUDIES	1st Cycle		
COURSE CODE	COMP-448	**SEMESTER**	Fall
COURSE TITLE	Computer Vision		

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**
	2.5	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*	Specialization
PREREQUISITE COURSES:	COMP-221 and MATH-280
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

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*

At the end of this course, students should:

- Understand the fundamentals of classic computer vision
- Be able to identify the recent trends and developments in artificial intelligence and particularly deep learning for computer vision
- Identify limitations of the current state of the field and the immense potential for commercial applications of computer vision
- Apply mathematical methods in a rigorous manner in order to solve computer vision tasks
- Know how an image is formed and how cameras work

- Know what features are and how they are extracted from an image
- Know what edge and corner detection is
- Know how features are described, stored and how they are used to solve computer vision problems
- Understand classic computer vision algorithms such as RANSAC or Normalized cuts as well as methods such as PCA
- Be confident in camera models and projective transformations
- Know what camera extrinsic and intrinsic parameters are how to perform camera calibration
- Understand how stereo and multi-view reconstruction works, and be able to appreciate structure from motion algorithms
- Understand high-level tasks such as segmentation, recognition, detection
- Know how many of these problems can be solved with deep neural networks

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	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Adapting to new situations

Decision-making

Working independently

Production of new research ideas

Project planning and management

Criticism and self-criticism

Production of free, creative and inductive thinking

SYLLABUS

1. Introduction to Computer Vision
2. Fundamentals – Image Formation & Cameras
3. Fundamentals - Color
4. Filtering – Edge and corner detection
5. Feature descriptors and matching
6. Fitting, RANSAC, Image alignment & stitching
7. Recognition
8. Segmentation
9. Camera models – Projective Transformations

10. Camera calibration
11. Epipolar geometry – Stereo reconstruction
12. Multi-view stereo – Structure from Motion
13. Optical flow
14. Neural networks fundamentals
15. Convolutional neural networks

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 ICT in teaching / Χρήση ΤΠΕ* *Communication with students / Επικοινωνία με Φοιτητές*
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*	
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.*	Midterm Exam Coursework & Assignments. Final Exam

Activity	***Semester workload***
Lectures	35
Preparation, homework	60
Coursework & Assignments	28
Exam preparation	25
Final Exam	2
Course total	***150***

ATTACHED BIBLIOGRAPHY

Required Textbooks / Readings:

Title	**Author(s)**	**Publisher**	**Year**	**ISBN**

Computer Vision: Algorithms and Applications*	Richard Szeliski	Springer	2022	978-3-030-34371-2
Computer Vision – A Modern Approach	David A. Forsyth and Jean Ponce	Pearson	2011	978-0-136-08592-8

Recommended Textbooks / Readings:

Title	**Author(s)**	**Publisher**	**Year**	**ISBN**
Multiple View Geometry in Computer Vision	Richard Hartley and Andrew Zisserman	Cambridge University Press	2004	978-0-511-81168-5
Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	2006	978-0-387-31073-2
Deep Learning**	Ian Goodfellow and Yoshua Bengio and Aaron Courville	MIT Press	2016	978-0-262-03561-3