MODULE **DESCRIPTOR**

MODULE TITLE	Computer Vision		
MODULE CODE	EL3105 (L6)	**CREDIT VALUE**	20 UK CREDITS / 10 ECTS
SCHOOL	SCHOOL OF SCIENCES		

MODULE **AIMS**

•To introduce students to fundamental theoretical tools, essential for understanding modern computer vision.
•To provide students with the theoretical, analytical and practical skills that will enable them to design, build and use computer vision systems.
•To develop their investigative skills, which enable them to study, comprehend, and use future developments in computer vision.

MODULE **CONTENT**

Indicative syllabus content:

Introduction to Computer Vision
Computer vision versus image processing and computer graphics.

Image Formation Process.
Fundamental concepts of geometric optics, camera models, lenses, optical image formation, radiometry of imaging.

Elements of Projective Geometry.
Geometry of perspective projection, vanishing points and lines, projective coordinates, 2D projective spaces, fundamental duality in projection spaces.

Camera Calibration.
Geometric calibration, estimation of the projection matrix, camera parameters from the projection matrix, lenses distortions correction; Photometric calibration, photometric sensor model, gamma correction, black level and white balance correction.

Practical Aspects of Computer Vision Systems.
Lighting, lenses, cameras, frame-grabbers.

Stereovision and Multi-camera Systems.
Correspondence problem, epipolar geometry, essential and fundamental matrices, image rectification, 3D reconstruction, multi-camera systems.

Range Data
Active and passive 3D scanners, range data representation, range data segmentation and registration.

Motion
Optical flow, estimation of the motion field, image mosaic construction, object tracking.

Recognition
Image eigenspaces, supervised and unsupervised learning for pattern recognition applications.

Examples of Applications of Computer Vision Techniques
Robot navigation, industrial inspection, automatic 3D models construction, virtual and augmented reality technologies, head tracking, face recognition, HCI.

INTENDED **LEARNING OUTCOMES**

On successful completion of this module a student will be able to:

1.	Demonstrate the ability to interpret and analyse the physical phenomena as well as understand mathematical modelling theories necessary to explain image formation processes.
2.	Produce design briefs, specifications and concepts for computer vision systems.
3.	Demonstrate an understanding of issues related to camera modelling, camera calibration, stereovision, range data acquisition representation and interpretation, object recognition, motion modelling and estimation.
4.	Develop an awareness of research areas in computer vision.
5.	Research, select and review appropriate literature.

TEACHING METHODS

Lectures, seminar exercises and laboratory sessions provide students with an appropriate knowledge base. The directed assignment broadens the students' knowledge and experience of computer vision and helps to integrate learning outcomes. The laboratory sessions allow the students to experiment with, and investigate the performance of the computer vision tools and techniques. The seminar exercises enable students to practice and develop analytical and design skills, they also provide an opportunity to give formative feedback.

ASSESSMENT METHODS

This module is assessed through a written examination and a written assignment.