

<b>Module Title:</b>	Robotic Operating Systems
<b>Language of Instruction:</b>	English
<b>Credits:</b>	5
<b>NFQ Level:</b>	7
<b>Module Delivered In</b>	<a href="#">2 programme(s)</a>
<b>Teaching &amp; Learning Strategies:</b>	This module will be delivered through a mix of lectures, laboratory assignments, and projects including a professional write-up. It will employ a mixture of active/task-based learning, reflective learning, and problem-based learning.
<b>Module Aim:</b>	Robotic systems are implementing their control systems using the Robot Operating System (ROS) in both industry and academia. ROS supplies a development environment for modular control and communication infrastructure of robotic systems using an open-source library of control and data processing algorithms. In this course, we shall cover the development of software modules in ROS and integration into a completely functional system for autonomous robot control.

Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Use ROS communication tools to exchange information to create and visualise a custom robot environment.
LO2	Analyse and map an environment and navigate a mobile robot around that environment
LO3	Implement a pick-and-place function with industrial robot arms.
LO4	Design a complete robotic application with state machines within an individual or group project setting depending on the complexity.

Pre-requisite learning	
<b>Module Recommendations</b> <i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
<b>Incompatible Modules</b> <i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
<b>Co-requisite Modules</b>	
No Co-requisite modules listed	
<b>Requirements</b> <i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
OS (Linux), Programming (variables, loops, functions, conditionals), linear algebra.	

## Module Content & Assessment

Indicative Content
<b>Linux operating system refresher</b> Linux install, ROS installation etc
<b>Programming language refresher</b> Python and C/C++
<b>Introduction to the Robot Operating System</b> Services, actions, nodes in ROS. Control systems in SCADA.
<b>Unified Robot Description Format</b> Use Unified Robot Description Format (URDF), ROS parameter server, and simulation of real-world object representations.
<b>Robot vision</b> Robot vision with object detection and pose estimation
<b>State machines and file systems</b> State machines design and behaviour and the ROS file system and SCADA logs.
<b>Map creation and navigation</b> Map creation and autonomous navigation of a known map e.g., GMapping
<b>Motion Planning and Behaviour</b> Motion planning and pick and place behaviours using industrial robots e.g., ROS MoveIt.
<b>Safety and Cybersecurity</b> Coding styles and standards for safety, security and key management, Penetration testing support.

Assessment Breakdown	%
Continuous Assessment	50.00%
Project	50.00%

Continuous Assessment				
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	n/a	1,2,3,4	50.00	Every Week

Project				
Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Project	n/a	1,2,3,4	50.00	Sem 2 End

No Practical
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No End of Module Formal Examination
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SETU Carlow Campus reserves the right to alter the nature and timings of assessment

**Module Workload**

<b>Workload: Full Time</b>		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	Every Week	2.00
Laboratory	Every Week	3.00
Independent Learning	Every Week	3.00
Total Hours		8.00

**Module Delivered In**

Programme Code	Programme	Semester	Delivery
CW_EEROB_B	<a href="#">Bachelor of Engineering (Honours) in Robotics and Automated Systems</a>	5	Mandatory
CW_EEROO_D	<a href="#">Bachelor of Engineering in Robotics and Automated Systems</a>	5	Mandatory