**MODULE CODE MODULE NAME CREDITS**

EMAP301 Marine Automation & Programming 302 14

**PURPOSE**

Process control and instrumentation is a growing field of study that has gained widespread attention over the past century owing to several technological breakthroughs that have taken place. The advent of the microchip in particular, has enabled this field to progress further than ever before.

In this course learners are introduced to Electronic Measurement Systems, Process Modelling and Marine Automation Systems. The fundamental tools and techniques for control system modelling, analysis and design are also introduced. The aim of this course is to provide the core knowledge, principles and techniques necessary to analyse, design and implement digital feedback control systems for the control of various marine processes.

After completing this module, the student should be able to:

* Describe the physical principles, required sensors and the underlying instruments used to implement the measurement of pressure, temperature, flow, level and vibration.
* Describe what a control system is, why feedback is incorporated into most control systems, types of control systems and identify all the basic components.
* Apply the Laplace Transform to solve linear ordinary differential equations and transfer functions to model basic linear time-invariant systems.
* Model physical integrated maritime systems using fundamental tools: Linear systems, differential equations and transfer functions.
* Perform time-domain analysis of linear continuous data control systems and relate time-response criteria to systems parameters.
* Perform frequency-domain analysis of linear continuous data control systems and relate frequency-response characteristics with system parameters.
* Use time and frequency-domain analysis tools to design control systems including PD, PI and PID controllers.
* Explain the principles and main methods of analogue-to-digital and digital-to-analogue conversion.
* Explain the principles of digital signal processing.
* Describe the principle of operation of linear valve actuators, pneumatic, electric and hydraulic actuators, rotary actuators and flow control valves.
* Develop and interpret basic electrical, hydraulic and pneumatic diagrams.
* Given engineering performance requirements, identify and select instrumentation and automatic control systems for basic marine applications.
* Given engineering performance requirements, identify and select instrumentation and automatic control systems for basic marine applications.
* Develop and interpret basic electrical, hydraulic and pneumatic diagrams.
* Apply programming tools and logic functions to configure, perform data acquisition, and process parameter scaling, actuator control and system automation using Programmable Logic Controllers.

# ESSENTIAL CONTENT

The following are essential aspects/ topics of this course:

* Basic Concepts and Principles of Digital systems.
* Basic Concepts and Principles of Measurement Methods.
* Static and Dynamic Characteristics of Signals and Systems.
* Measurement of Physical Variables related to Marine Engineering.
* Sensors, Transmitters and Control Actuators related to Marine Engineering.
* Mathematical and System Level Modelling of Marine Control Systems.
* Control system specification and design
* Fundamental Components and Time Domain Performance of Marine Control Systems.
* Safe Application of Power and Control Circuits.
* Fundamentals of PLC programming.

**ASSESSMENT**
Class Mark – 40%, Examination Mark – 60%

**MODERATION**

Internal

**PREREQUISITE MODULE/s**

MATV302 (Mathematical Modelling, Differential Equations, Laplace Transform Theory), EMES202 & PHY102

**CO-REQUISITE MODULE/s**

None