**MODULE CODE MODULE NAME CREDITS**

EMAA302 Marine Advanced Automation 302 14

**PURPOSE**

Automatic control systems, alarming and monitoring and service and maintenance are key components that altogether contribute to safe, accurate and efficient operation of an integrated maritime system. This module will enable the marine engineer to understand and apply principles and theory of instrumentation, calibration techniques, automatic control engineering and control strategies for marine applications, practical use of controllers and Totally Integrated Automation using Supervisory Control and Data Acquisition (SCADA) systems.

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

* Evaluate fundamental automatic control concepts and identify with process control terminology.
* Outline the importance of calibration and traceability as applied to instrumentation.
* Explain and apply the procedures required to achieve reliable calibration data and identify inherent errors.
* Perform calibrations on pressure, temperature, level and flow measurement instruments.
* Make use of P&ID diagrams to graphically represent real maritime processes and be familiar with a wide variety of common process symbols.
* Apply advanced structured programming techniques to create sequential PLC programs for maritime applications.
* Evaluate modes of process operation, control schemes, time and frequency responses.
* Identify and evaluate causes of control system instability and design appropriate controller solutions.
* Describe and implement the digitized form of proportional, integral and derivative control and various combinations of these terms.
* Identify and describe the mathematical form of the most important building blocks used in digital control.
* Tune PID controllers in both open and closed loop control systems using standard techniques such as Zeigler Nichols.
* Interpret and solve numerical problems from controller responses, apply tuning methods and optimize valve sizing.
* Use and describe suitable control methods to regulate variables such as flow, level, pressure and temperature in simulated and real life environments as applied to marine engineering.
* Design and implement suitable SCADA solutions for the visualization and control of maritime applications.

**ESSENTIAL CONTENT**

The following are essential aspects/ topics of this course:

* Fundamental Control Concepts, Automatic Control Terminology and Control Modes.
* Controller Responses, Tuning Methods and Stability.
* Control Valve Characteristics, Factors Influencing Selection, Valve Sizing and Positioners.
* P&ID Representations
* Digital Control Principles and Real-time Programming.
* Marine Control Strategies: Feed forward, Cascade, Ratio, Spilt range, Interlocks and Dead time.
* Regulate Variables such as Flow, Level, Pressure and Temperature.
* Case studies on Operation and Properties of Common Marine Operations such as Boilers, Heat exchangers, Air compressors, Drying systems, Refrigeration, Desalination and Effluent treatment and Disposal.
* Operating and Monitoring using SCADA: PLC Integration, Graphics, Message Alarming and Trending, and Data Logging.

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

**MODERATION**

Internal

**PREREQUISITE MODULE/s**

EMAP301

**CO-REQUISITE MODULE/s**

None