WM289-15 Introduction to Automation and Control

26/27

Department
WMG
Level
Undergraduate Level 2
Module leader
Wael Alsaafin
Credit value
15
Module duration
14 weeks
Assessment
100% coursework
Study locations
University of Warwick main campus, Coventry Primary
Distance or Online Delivery

Description

Introductory description

This module explains the methodologies and techniques for control of automated industrial processes and machines which vary in time or based on events. It fosters theoretical and practical knowledge on:

- Technology of actuators and sensors commonly used in industrial automation,
- Techniques for design of digital PID controllers
- Basic digital electronics and logic design.
- Hardware and software architecture of Programmable Logic Controllers (PLCs)
- PLC ladder programming.
- Design and implementation of control systems using PLCs

Examples: sizing of electric motors for a robotic arm, programming of logic controllers for a pick and place application on a conveyor belt, tuning of a digital PID for speed control of a CNC machine.

This module is linked with C1, C2, C3, C4, C6, C13, and C17, of the AHEP 4.

LO1 : C3, C4, C13.
LO2 : C1, C2, C17.
LO3 : C1, C6.
LO4 : C2, C3, C17.

Module web page

Module aims

This module aims at providing fundamental knowledge on how to utilise actuators and sensors for motion control, digital circuit design, and Programmable Logic Controllers (PLCs).
It provides underpinning for the following modules in Y3 & Y4 on both Control Systems and Electrical/Electronic streams of the APEP programme.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Actuators and selection criteria: electric, pneumatic, and hydraulic actuators.
Sensors and selection criteria: position, force, proximity/distance, and vision sensors.
Sensor periphery: Amplifiers, filters, etc.
Motors: DC, synchronous brushless, asynchronous, and stepper motors.
Motion control: architecture of motion control systems; PID controller; motion control with DC motor; kinematic chains; motion synchronization.
Digital Electronics and Logic Design: logic gates, Boolean algebra, truth tables, Karnaugh maps, digital electronics.
Programmable Logic Controllers (PLCs): PLC architecture, PLC programming, memory addressing, scan cycle, ladder diagram, PLC timers, PLC counters.

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate acquired knowledge in selecting actuators and sensors suitable for a given motion control system [AHEP:4 – C3, C4, C13]
- Demonstrate knowledge of tuning a digital PID to satisfy given static and dynamic specifications [AHEP:4 – C1, C2, C17]
- Design and implement control systems using programmable logic controllers PLCs [AHEP:4 – C1, C6].
- Apply basic logic and digital electronic circuits to practical systems [AHEP:4 – C2, C3, C17].

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

- Translate conceptual designs or technical specifications into operational process control systems (S1 in ST0023) or operational designs or specifications for systems or components to solve electrical/electronic challenges (S1 in ST0024).
- Select, use and apply approved problem-solving methods to solve complex problems and determine appropriate solutions (S2 in ST0023 and ST0024).
- Select the best method for collating and conveying complex information using a range of data sources and supporting documentation (S3 in ST0023).
- Interpret and produce technical documentation such as schematic and circuit diagrams (S4 in ST0023), simulation models (S4 in ST0024).
- Demonstrate leadership when undertaking control system engineering activities such as system design, integration operational simulation of control systems (S10 in ST0023).
- Lead electrical/electronic engineering activities (S11 in ST0024).
- Identify areas for improvement and lead continuous improvement activities in the operation and performance of the system or component (S14 in ST0024).

Transferable skills

- Digital literacy: Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content.
- Teamwork: Operate within, and contribute to, a respectful, supportive and cooperative group climate; Sensitive to the impact of actions on others.
- Critical thinking: Recognise patterns, themes and key messages from sometimes confused and incomplete data; Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.
- Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions.
- Communication: Written: Present arguments, knowledge and ideas, in a range of formats.

Study

Study time

Type	Required
Lectures	12 sessions of 1 hour (8%)
Seminars	9 sessions of 1 hour (6%)
Practical classes	3 sessions of 1 hour (2%)
Online learning (scheduled sessions)	6 sessions of 1 hour (4%)
Online learning (independent)	10 sessions of 1 hour (7%)
Other activity	5 hours (3%)
Total	150 hours

Type	Required
Private study	45 hours (30%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Self-guided study: revision on module contents, solution of additional seminar-type questions, video tutorials and supplementary materials.
Study and use of simulation software.
Online forum and discussion (asynchronous).

Other activity description

On-line support / consultancy during the off-campus work on assessments.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Assessment component			
Assignment 1	40%	24 hours	Yes (extension)
Written individual report on digital motion control design. Students can work in groups of 2 or 3, but each student must submit their own report.			
Reassessment component			
Assignment 1 Resubmission			No
Written individual report on digital motion control design. Students can work in groups of 2 or 3, but each student must submit their own report.			

	Weighting	Study time	Eligible for self-certification
Assessment component			
Assignment 2	60%	36 hours	Yes (extension)
Written individual report on design and simulation of digital logic circuit and PLC ladder diagram for a given set of sensors, actuators and processes. Students can work in groups of 2 or 3, but each student must submit their own report.			
Reassessment component			
Assignment 2 Resubmission			No
Written individual report on design and simulation of digital logic circuit and PLC ladder diagram for a given set of sensors, actuators and processes.			

Feedback on assessment

Formative Feedback:

- verbal formative feedback given during seminar/tutorial sessions,

Summative Feedback:

- written individual feedback on the assignment 1 report,
- written individual feedback on the assignment 2 report.

Availability

Courses

This module is Core for:

- Year 3 of UWMS-H7C3 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer)
- Year 3 of UWMS-H7C2 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer)
- Year 3 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Professional Applied Engineering