WM3H2-15 Connected Metrology

26/27

Department
WMG
Level
Undergraduate Level 3
Module leader
Matthew Pitts
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 stream-specific 15 CATS module builds on concepts introduced and explored in the year 3, 30 CATS long module, and in preceding modules. The module addresses core concepts of Industry 4.0, through a focus on Metrology technologies and Quality Systems, adopting a systems engineering approach to the complex problem of quality assurance in the modern digital engineering environment.

The first part of the module introduces the concept of Industry 4.0 and its enabling technologies, providing a broad overview of core aspects. Fundamental concepts of signals, sensors and data acquisition (DAQ) are introduced, providing learners with a core understanding of how data from physical systems can be used to drive analytics and support informed decision making.

Study of Metrology applications and technologies focuses on modern non-contact 3D measurement approaches, with an in-depth examination of in-line Metrology, its benefits and challenges. The role of these approaches and technologies for Quality Systems in a modern digital engineering enterprise is addressed throughout.

This module is linked with C4, C6, C13, C14, C16 of the AHEP 4.

LO1 - C6, C13
LO2 - C13

LO3 - C14
LO4 - C4, C13
LO5 - C16

Module web page

Module aims

The primary aim of the module is to introduce and explore key concepts of Industry 4.0, with a focus on modern digital quality assurance approaches and Metrology systems. This builds on prior learning from the course, extending topics relating to product quality, and introduces leading-edge technologies as applied in industry.

In doing so, students will gain an understanding of current industry trends, such as the development of non-contact measurement technologies and the drive towards in-line Metrology, allowing them to evaluate how these innovations may impact product development practices going forward. This is further supported by exploration of the fundamentals of signals, sensors and data acquisition that underpin connected technologies for Industry 4.0.

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.

- Industry 4.0 (Overview/Metrology focus)
- Applied Geometrical Dimensioning and Tolerancing
- Measurement Uncertainty
- In-Line & In-Process Metrology
- Non-Contact Measurement Technologies
- Optical Inspection Methods
- Computed Tomography
- Industrial Internet-of-Things
- Signals and Sensors
- Data Acquisition (DAQ)
- Augmented Reality & Virtual Reality Applications

Learning outcomes

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

- Evaluate core technologies for industry 4.0 from a systems engineering perspective and how they apply to the product life cycle/product development [AHEP:4 - C6, C13]
- Determine the benefits & challenges of modern Metrology approaches including in-line Metrology [AHEP:4 - C13]
- Discuss the implications of modern inspection technologies for Quality Management and Assurance Systems [AHEP:4 - C14]
- Select appropriate sensors and data acquisition solutions for application to a connected industrial system [AHEP:4 - C4,C13]

- Appraise the ability to work as an individual or a team member to meet specified objectives of complex engineering projects [AHEP:4 - C16]

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

1. Translate conceptual ideas or technical requirements into developmental outcomes or operational designs or specifications for systems or components to solve manufacturing challenges such as compliance, technology, technical or physical challenges (S1 in ST0027)
2. Collate and use a range of data sources and supporting information to support projects (S3 in ST0027)
3. Interpret and produce technical documentation such as schematic and circuit diagrams, engineering drawings or 3D CAD models, simulation models, project plans, engineering reports, test reports, fault reports or data analytics using company documentation systems and guidelines (S4 in ST0027)
4. Observe, record and draw accurate and auditable conclusions from data and/or developmental or test evidence (S5 in ST00027)
5. Identify resources, such as digital tools or technologies, human, equipment, materials or data, to complete design and development projects or programmes of work (S8 in ST0027)

Transferable skills

- Critical thinking
- Problem solving
- Communication
- Teamwork and working effectively with others
- Information literacy
- Digital literacy
- Professionalism
- Organisational awareness

Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (7%)
Total	150 hours

Type	Required
Seminars	8 sessions of 1 hour (5%)
Practical classes	3 sessions of 1 hour (2%)
Online learning (scheduled sessions)	9 sessions of 1 hour (6%)
Online learning (independent)	5 sessions of 1 hour (3%)
Other activity	5 hours (3%)
Private study	50 hours (33%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Additional questions on the subject matter.

Online forum and discussion (asynchronous).

Other activity description

Online support / consultancy for the assignments

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	No

Group Report on systems engineering-based industrial instrumentation case study
Typical group will consist of 4 or 5 students. Peer-marking will be applied in accordance with WMG policy.
Students will determine appropriate signal, sensors and data acquisition solutions for a given scenario, using a systems engineering approach.

	Weighting	Study time	Eligible for self-certification
Reassessment component			
Assessment 1 re-assessment			No
Individual Report based on a simplified industrial instrumentation case similar to assignment 1 but with reduced complexity. Student will determine appropriate signal, sensors and data acquisition solutions for a given scenario, using a systems engineering approach.			
Assessment component			
Assignment 2	60%	36 hours	Yes (extension)
Individual report - In-line Metrology case study. Student will identify enabling industry 4.0 technologies and produce an analysis of an in-line metrology application, evaluating appropriate measurement technologies, strengths, weaknesses & mitigations, with reference to quality management systems.			
Reassessment component			
Assignment 2			No
Individual report - In-line Metrology case study. Student will identify enabling industry 4.0 technologies and produce an analysis of an in-line metrology application, evaluating appropriate measurement technologies, strengths, weaknesses & mitigations, with reference to quality management systems.			

Feedback on assessment

Formative verbal feedback during tutorial sessions on report progress
Formative feedback from Moodle/Vevox quiz activities

Summative, written group feedback on written reports-Assignment 1.
Summative, written individual feedback- Assignment 2

Availability

Courses

This module is Core for:

- Year 3 of UWMS-H7C1 Undergraduate Applied Professional Engineering (Manufacturing

Engineer)
- Year 3 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 3 of UWMS-H7C4 Undergraduate Applied Professional Engineering (Product Design and Development Engineer)
- Year 3 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)