WM273-15 Instrumentation & Control

26/27

Department
WMG
Level
Undergraduate Level 2
Module leader
Siavash Amin-Nejad
Credit value
15
Module duration
14 weeks
Assessment
60% coursework, 40% exam
Study locations
University of Warwick main campus, Coventry Primary
Distance or Online Delivery

Description

Introductory description

Instrumentation and control is the nervous system of industrial complexes, power generation, and basically all the processes that require some intelligence to accomplish the task of producing a product or process.

This module is linked with C1, C2, C3, C6, C13, C16 and C17 of AHEP 4
LO1: C13
LO2 : C1, C2, C6
LO3 : C1, C2, C3, C6
LO4 : C3, C17
LO5 : C16

Module web page

Module aims

This module aims to provide the students with an understanding of concepts, components, analogue systems and digital systems for industrial measurements and for process control. It will equip students with knowledge on how different sensors, controllers and actuators, with their limits, can form different open-loop and closed-loop control systems. Examples, simulations and

analytical work underpin the learning of simple and moderately complex control systems: discrete (ON/OFF, floating, multi-level) and continuous (proportional, integral, PID).

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.

Instrumentation for control purposes:

- Industrial data representation, analogue and digital signal processing, passive circuits,
- Analog-to-digital and digital-to-analogue converters,
- Operational amplifier circuits in instrumentation, comparators, amplifiers, instrumentation amplifiers,
- Thermal, mechanical and optical sensors; associated measurement circuits,
- Actuators: heaters, relays, electric motors,
  Process-control systems
- Introduction to process-control systems,
- Block diagrams and transfer functions of continuous systems,
- Open-loop and closed-loop systems: basics & modelling,
- Proportional, integral and derivative mode controllers,
- Steady-state and transient performance - comparison with simulation studies.
  Analysis of feedback systems
- Basic concepts of feedback control,
- Transfer functions, Bode diagrams,
- Steady-state and transient response of linear systems to impulse, ramp and step inputs.

Learning outcomes

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

- Describe the functionality and performance of various sensors used in instrumentation and control [AHEP:4- C13]
- Analyse electronic circuits found in analogue and in digital instrumentation systems [AHEP:4- C1, C2, C6]
- Apply mathematical techniques to design and analyse analogue measurement and control systems [AHEP:4- C1, C2, C3, C6]
- Design control modules using simulation tools for broadly defined processes [AHEP:4- C3, C17]
- Function effectively as an individual, and as a member or leader of a team [AHEP:4, C16]

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

- Select, use and apply approved problem-solving methods to solve complex problems and determine appropriate solutions or actions such as Define, Measure, Analyse, Improve, and Control (DMAIC), Failure Mode Effects Analysis (FMEA) or Plan-Do-Check-Act (PDCA). (S2 in all standards)
- Interpret and produce technical documentation such as schematic and circuit diagrams, engineering drawings or CAE models, simulation models, project plans, engineering reports, test reports, fault reports or data analytics using company documentation systems and guidelines. (S4 in all standards)
- Observe, record and draw accurate and auditable conclusions from data and/or developmental or test evidence. (S5 in all standards)

Transferable skills

- Digital literacy
- Information literacy
- Critical thinking.
- Problem-solving.
- Teamwork
- Communication

Study

Study time

Type	Required
Lectures	9 sessions of 1 hour (6%)
Seminars	6 sessions of 1 hour (4%)
Online learning (scheduled sessions)	15 sessions of 1 hour (10%)
Online learning (independent)	10 sessions of 1 hour (7%)
Other activity	5 hours (3%)
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 before assessments.
Mock exam independent practice.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D1

	Weighting	Study time	Eligible for self-certification
Assessment component			
Assignment	60%	36 hours	No
Written group report on a numerical and simulation study. Peer Adjustment will be used for awarding the individual marks.			
Reassessment component			
Assignment			No
Written Individual report on a numerical and simulation study.			
Assessment component			
Online exam	40%	24 hours	No
Exam consisting of theoretical and calculation-based questions. Numbers in calculation-based problems are individualized for each student. Formula sheets are available during the exam.			
Reassessment component is the same			

Feedback on assessment

FORMATIVE:

- Automated Individual feedback on on-line Moodle Revision Quiz.
- Cohort-level feedback on on-line Mock Exam.
- Individual, verbal feedback on problem sets given during seminar/tutorial sessions throughout the course

SUMMATIVE:

- written cohort-level feedback on the exam,
- written individual feedback on the assignment reports.

Past exam papers for WM273

Availability

Courses

This module is Core for:

- Year 2 of UWMS-H7C3 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer)
- Year 2 of DWMS-H7C7 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer) (Degree Apprenticeship)
- Year 2 of UWMS-H7C2 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer)
- Year 2 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Year 2 of UWMS-H7C1 Undergraduate Applied Professional Engineering (Manufacturing Engineer)
- Year 2 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 2 of UWMS-H7C4 Undergraduate Applied Professional Engineering (Product Design and Development Engineer)
- Year 2 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)