ES372-15 Automation and Robotics

20/21

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Emma Rushforth
Credit value
15
Module duration
14 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES372-15 Automation and Robotics

Module web page

Module aims

The module provides an understanding of the principles of operation of automated equipment with particular reference to industrial robots. It focuses on the knowledge needed to select and use such equipment effectively and safely. However, some design aspects will be presented. There is an emphasis on the use of sensors to make robots behave "intelligently".

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.

Introduction to automation and robotics: Fiction and history from Leonardo da Vinci onwards; Classification of robots; Fixed and flexible automation; High speed automation. Social and economic aspects; Safety issues and risk assessment;.
Machine design: Degrees of freedom; Actuators and power transmission; End effector design;

Robot accuracy.
Machine control: Servomechanisms; PLC’s and fieldbus; Robot Kinematic analysis.
Sensors and Machine vision: Transducers, tactile and proximity sensors; Vision - image analysis, cameras, optics, lighting and applications.
Robot programming and languages: Methods of programming; Teach mode, off line, and graphical simulation. Languages, e.g. ABB RAPID, ABB RobotStudio.

Learning outcomes

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

- Appraise the impact of automation (benefits and disadvantages), both economic and social, on modern industry.
- Evaluate the different mechanical configurations available for a modern industrial robot and argue if a task is appropriate for that configuration.
- Program an industrial robot off-line using kinematic simulation software to perform a specified task.
- Locate the sources of positional error and calculate the possible positional error in an application.
- Analyse safety hazards or formulate a safety system for a given automation application.
- Select and apply appropriate sensors and/or machine vision to a given application and set up a machine vision system.
- Analyse complex robot kinematic theory and devise kinematic calculations for a given case study.

Indicative reading list

"An Introduction to Robotics Analysis, Systems, Applications", Niku, S.B, 2010, 9780470604465, TJ 211.N4
"Implementation of Robotic Systems", Wilson, Mike, 2014, 9780124047334, EBOOK/ TS191.8.W55
"Introduction to robotics : mechanics and control", Craig, J. J, 2013, 9781292040042, TJ 211.C7
“Robotics: A Very Short Introduction”, Winfield, Alan, 2012, 9780199695980, TJ211.W56
“Principles of Modern Manufacturing” Groover, Mikell P., 2013 9781118474204, TS183.G763

Subject specific skills

Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk
Ability to be risk, cost and value-conscious, and aware of their ethical, social, cultural, environmental, health and safety, and wider professional engineering responsibilities
Ability to apply relevant practical and laboratory skills
Ability to conceive, make and realise a component, product, system or process

Transferable skills

Numeracy: apply mathematical and computational methods to communicate parameters, model

and optimize solutions
Appreciation of the global dimensions of engineering, commerce and communication
Awareness of the nature of business and enterprise in the creation of economic and social value
Overcome difficulties by employing skills, knowledge and understanding in a flexible manner

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Study

Study time

Type	Required
Lectures	26 sessions of 1 hour (17%)
Other activity	14 hours (9%)
Private study	110 hours (73%)
Total	150 hours

Private study description

109.5 hrs guided independent learning

Other activity description

Up to 5 hours Robot Programming Surgeries drop-in in a computer room
Up to 7 hours Machine Vision Surgeries drop-in in a computer room
1.5 hour Machine Vision Laboratory
Up to 1 hour Robot Programming Laboratory (length dependant on how many attempts are needed to achieve successful program).

Costs

Category	Description	Funded by	Cost to student
Equipment and project costs	Purchase/borrow a USB memory stick/flash drive for transfering programs to a robot Protractor for use in exam	Student	£4.00

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D3

	Weighting	Study time
Online Test: Robot & Machine Vision Laboratory Exercise	30%	
Online Examination	70%	

2 * 1 hour QMP online tests to be scheduled in same time slot with short break inbetween

~Platforms - QMP

- Answerbook Pink (12 page)
- Engineering Data Book 8th Edition
- Graph paper
- Students may use a calculator

Feedback on assessment

Feedback on online assessments is via individual emails giving written feedback for each response.
Cohort level feedback on examinations

Past exam papers for ES372

Availability

Courses

This module is Core for:

- Year 3 of UESA-H335 BEng Automotive Engineering
- Year 4 of UESA-H334 BEng Automotive Engineering with Intercalated Year
- Year 3 of UESA-HH73 BEng Manufacturing and Mechanical Engineering
- Year 3 of UESA-HH75 BEng Manufacturing and Mechanical Engineering
- Year 4 of UESA-HH74 BEng Manufacturing and Mechanical Engineering with Intercalated Year
- Year 3 of UESA-HH35 BEng Systems Engineering
- Year 3 of UESA-HH36 BEng Systems Engineering
- Year 4 of UESA-HH34 BEng Systems Engineering with Intercalated Year
- Year 3 of UESA-H336 MEng Automotive Engineering
- Year 3 of UESA-HH76 MEng Manufacturing and Mechanical Engineering
- UESA-HH38 MEng Manufacturing and Mechanical Engineering with Intercalated Year
    - Year 3 of HH38 Manufacturing and Mechanical Engineering with Intercalated Year MEng

    - Year 4 of HH38 Manufacturing and Mechanical Engineering with Intercalated Year MEng
- UESA-HH31 MEng Systems Engineering
    - Year 3 of HH31 Systems Engineering
    - Year 3 of HH35 Systems Engineering

This module is Core optional for:

- Year 4 of UESA-H337 MEng Automotive Engineering with Intercalated Year
- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-HH38 MEng Manufacturing and Mechanical Engineering with Intercalated Year
    - Year 3 of HH38 Manufacturing and Mechanical Engineering with Intercalated Year MEng
    - Year 4 of HH38 Manufacturing and Mechanical Engineering with Intercalated Year MEng
- UESA-HH77 MEng Manufacturing and Mechanical Engineering with Intercalated Year
    - Year 3 of HH77 Manufacturing and Mechanical Engineering MEng with Intercalated Year
    - Year 4 of HH77 Manufacturing and Mechanical Engineering MEng with Intercalated Year
- Year 4 of UESA-HH32 MEng Systems Engineering with Intercalated Year

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
    - Year 3 of H112 Engineering
    - Year 3 of H112 Engineering

This module is Option list B for:

- Year 3 of UESA-HN12 BEng Engineering Business Management
- Year 3 of UESA-HN15 BEng Engineering Business Management
- Year 4 of UESA-HN13 BEng Engineering Business Management with Intercalated Year