

Unit 45: Industrial Systems

Unit code	T/615/1513
Unit level	5
Credit value	15

Introduction

The speed and efficiency of many industrial processes is due, largely, to the control systems selected for the application and the engineer's ability to apply the most appropriate technology for their operation.

This unit presents a structured approach to the development of advanced electronic solutions in a range of industrial situations. An essential requirement here is the engineer's ability to utilise the most appropriate technology for each application, to ensure the most efficient monitoring and control of variables such as pressure, temperature and speed.

Among the topics included in this unit are techniques and applications of electrical and electronic engineering, as they apply to various branches of industry, such as component handling, controlling the speed or torque of a motor or responding to change of circumstances in a process.

On successful completion of this unit students will be able to describe system elements and consider their overall characteristics. This provides opportunity for analytically assessing the accuracy and repeatability of electronic instruments.

Learning Outcomes

By the end of this unit students will be able to:

1. Describe the main elements of an electronically controlled industrial system.
2. Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers.
3. Apply practical and computer-based methods to design and test a measurement system.
4. Apply appropriate analytical techniques to predict the performance of a given system.

Essential Content

LO1 Describe the main elements of an electronically controlled industrial system

Fundamental concepts of industrial systems:

Discrete control

Input and output devices; open and closed loop systems

Describe the system elements and the principles and applications of important and representative AC and DC motors

LO2 Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers

Interfacing and transducers:

Discrete automation using relays and solenoids, AC and DC motors, pneumatic, hydraulic and electrical actuators, and other transducers and devices for measuring and comparing physical parameters

Interfacing between electrical, electronic and mechanical transducers

Practical measurement using sensors and transducers, process actuators for temperature and pressure control

LO3 Apply practical and computer-based methods to design and test a measurement system

System modelling and analysis:

The use of transfer functions to help predict the behaviour and constancy of an industrial process, including accuracy, resolution and tolerances, repeatability and stability, sensitivity and response time

Dealing with error and uncertainty in industrial systems

Use of computer packages in measurement and control, and dealing with uncertainty and errors in systems

LO4 Apply appropriate analytical techniques to predict the performance of a given system

Consideration of current trends in technology, including the future of industrial systems, the impact of digital developments, the increase of wireless and remote control and the Internet of Things

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
L01 Describe the main elements of an electronically controlled industrial system		D1 Critically examine the performance of an electronically controlled system to make recommendations for improvement
<p>P1 Describe the main elements of an electronically controlled industrial system</p> <p>P2 Review the main concepts underlying electronically controlled industrial systems</p>	<p>M1 Analyse the characteristics of an electronically controlled industrial system by applying a variety of techniques to the solution of a given problem</p>	
L02 Identify and specify the interface requirements between electronic, electrical and mechanical transducers and controllers		D2 Critically investigate the behaviour of a given control system to compare different electrical, electronic, and mechanical approaches to control
<p>P3 Identify the interface requirements between electronic, electrical and mechanical transducers and controllers</p> <p>P4 Justify the choice of transducers and controllers for a given task</p>	<p>M2 Predict the behaviour of an electronically controlled industrial system by applying a variety of transducers to the solution of a given problem and choose a 'best' solution</p>	
L03 Apply practical and computer-based methods to design and test a measurement system		D3 Critically evaluate the performance of an ideal measurement system compared to a real circuit
<p>P5 Apply practical and computer-based methods to design and test a measurement system</p> <p>P6 Explain the use of practical and analytical methods in creating and testing a measurement system</p>	<p>M3 Interpret the characteristics and behaviour of an existing electronic measurement system by applying a variety of methods to find a solution to a given problem</p>	

Pass	Merit	Distinction
LO4 Apply appropriate analytical techniques to predict the performance of a given system		D4 Analyse an existing industrial system by using appropriate analytical techniques Provide justified recommendations to improve the performance
P7 Apply the main analytical techniques to explain the performance of a given system	M4 Evaluate the characteristics of an electronically controlled industrial system by applying a variety of analytical techniques to the solution of a given problem	

Recommended Resources

Textbooks

- BIRD, J. (2013) *Electrical Circuit Theory and Technology*. Routledge.
- HUGHES, E. et al. (2012) *Electrical and Electronic Technology*. Pearson.
- REHG, J.A. and SARTORI, G.J. (2005) *Industrial Electronics*. Prentice-Hall.
- WILAMOWSKI, B.M. and IRWIN, J.D. (2011) *The Industrial Electronic Handbook: Fundamentals of Industrial Electronics*. CRC Press.

Websites

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| http://www.bath.ac.uk/ | University of Bath
Patents
(General Reference) |
| http://www.bsigroup.com/ | Business Standards Institution
Standards Catalogue
(General Reference) |
| https://www.ieee.org/ | Institute of Electrical and Electronics Engineers
Standards
(General Reference) |
| http://www.theiet.org/ | Institution of Engineering and Technology
(General Reference) |
| http://www.newelectronics.co.uk/ | New Electronics
Digital Magazine
(Journals) |
| http://www.theiet.org/ | Institution of Engineering and Technology
(Journals) |
| http://www.epemag.com/ | Everyday Practical Electronics
(Journals) |
| https://www.ieee.org/ | Institute of Electrical and Electronics Engineers
(Journals) |

Links

This unit links to the following related units:

Unit 19: Electrical and Electronic Principles

Unit 16: Instrumentation and Control Systems