WM9G9-15 System Reliability and Diagnosis

22/23

Department
WMG
Level
Taught Postgraduate Level
Module leader
Jane Marshall
Credit value
15
Module duration
3 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The module will investigate the way in which quality and reliability techniques can be used to guarantee the quality of manufacture. Conventional techniques associated with quality, reliability and maintenance will be introduced and used to quantify and diagnose common issues. The role of embedded intelligence to capture, process and share factory events and the role of data sciences in supporting this will be introduced through class-based exploratory exercises.

Module aims

To provide students with the means to evaluate technological risks associated with building and maintaining conventional and cyber-manufacturing systems and propose means to mitigate such risk to create high quality, reliable solutions.

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.

Quality Techniques for assessing process performance;
Six-Sigma;
Failure Mode Effect and Criticality Analysis, Fault tolerant design;
Related cyber-risk and how to protect against it;
Data Sciences and their role in prognostics and diagnostics.

Learning outcomes

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

- Examine the cyber-specific risks associated with the use of cyber-manufacturing
- Evaluate the effect of individual component availability on overall system reliability, maintenance and its effect on operational performance
- Compare and contrast the application of data-science methods to the problem of cyber-manufacturing
- Appraise the application of quality tools for process capability and process control.

Indicative reading list

Introduction to Statistical Quality Control, Montgomery, Douglas C. John Wiley, 2013
Reliability Engineering . Kailash C. Kapur and Michael Pecht, Wiley 2014;
Reliability centered maintenance (RCM): implementation made simple, Neil Bloom, McGraw-Hill, 2006;
Reliability Modeling and Analysis of Smart Power Systems, Karki Billinton & Verma (eds), Springer, 2014;
A Hands-on Introduction to Data Science. Chirag Shah, Cambridge University Press, 2020;
Cybersecurity of industrial systems , Flaus, Jean-Marie, ISTE, 2019;
Cyber Defence in the Age of AI, Smart Societies and Augmented Humanity. Jahankhani, Kendzierskyj, Chelvachandran & Ibarra (eds), Springer, 2020.

Subject specific skills

Use quality techniques such as SPC and SIx-Sigma to diagnose process performance and capability;
Analyse the potential sources and effect of faults in manufacturing processes;
Perform simple analysis of fault data using a relevant data-science technique.

Transferable skills

Dealing with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate conclusions clearly to specialist and non-specialist audiences;
Demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level;
Advance their knowledge and understanding, by developing new technical skills;
Independent learning ability required for continuing professional development.

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Seminars	6 sessions of 45 minutes (3%)
Demonstrations	3 sessions of 1 hour (2%)
Practical classes	5 sessions of 1 hour (3%)
Supervised practical classes	6 sessions of 1 hour (4%)
Online learning (independent)	23 sessions of 30 minutes (7%)
Assessment	105 hours (70%)
Total	150 hours

Private study description

No private study requirements defined for this module.

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
QRM Analytical Skills	5%	5 hours
Solve a series of problems related to the measurement and analysis of quality and reliability in manufacturing systems		
Conceptual Design using Machine Intelligence for Systems Support	15%	20 hours
Working in small teams, apply the module's core concepts and carry out preliminary research to conceive the conceptual design of a resilient cyber-manufacturing system		
Post Module Assignment	80%	80 hours
Select an existing firm that manufactures a complex product and based on this develop a balanced argument for or against the use of intelligent devices to support the maintenance of		

	Weighting	Study time

system integrity, reliability and performance.

Assessment group R

	Weighting	Study time
Post Module Resubmission Assignment	95%	

Select an existing firm that manufactures a complex product and based on this develop a balanced argument for or against the use of intelligent devices to support the maintenance of system integrity, reliability and performance.

QRM Analytical Skill Resubmission	5%	

Solve a series of problems related to the measurement and analysis of quality and reliability in manufacturing systems

Feedback on assessment

The worksheet will be marked, scanned and returned to the student;
The presentation will receive oral feedback and a checklist showing strengths and weaknesses;
The post module assignment will have written feedback

Availability

There is currently no information about the courses for which this module is core or optional.