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## ELEC08061 2024 System Integration

<b>Transcript Title</b>	System Integration		
<b>Gradebook Title</b>	System Integration		
<b>Status</b>	Uploaded to Banner	<b>Start Term</b>	2024
<b>NFQ Level</b>	08	<b>ECTS Credits</b>	05
<b>Attendance</b>	N/A	<b>Duration</b>	Semester - (15 Weeks)
<b>Subject Area</b>	0714 Electronics & Automation	<b>Delivery Mode</b>	Full Time, Blended
<b>Grading Mode</b>	Numeric/Percentage	<b>Failed Component</b>	None
<b>Department</b>	Electronic & Electrical Eng	<b>Campus</b>	Galway
<b>Module Author</b>	Carine Gachon		

### Module Description

This module will look at the data architecture of a manufacturing plant from manufacturing floor up to ERP level in accordance with the ISA-95. Students will learn how to assess an existing data architecture and plan for a new one taking into account validation requirements. On a practical level students will build a SCADA system integrating data from various equipments.

### Learning Outcomes

**On completion of this module the learner will/should be able to:**

1. Assess the existing data architecture of a manufacturing plant and its components.
2. Design specification for a data architecture based on user requirements considering sustainable development goals.
3. Plan horizontal and vertical integration of a data architecture in a manufacturing system.
4. Develop a data management system at SCADA level.
5. Develop an integration plan considering validation.

### Indicative Syllabus

#### Digital Maturity Assessment - 1 hr lecture

#### Digitalisation and sustainable Development Goals- 1hr

#### Vertical integration

- ISA-95, ISO 62264, B2MML - Overview (1hr lecture)
- ERP -Understanding the role of the ERP. (1 hr lecture)
- SDADA and Manufacturing Execution systems- Understanding their role and development of a SCADA/MES system. (20 hr practical-see below)
  - Data models- batch system, recipe management system, machine performance data (OEE), process monitoring parameters,...
  - Data interface, API, OPC and OPC UA
- Validation- Computer Software Assurance - GAMP5- Vmodel (2 hr lecture)

#### Horizontal integration

- Legacy equipment assessment–(hardware and communication system, code review assessment for data compatibility, Integration with new equipment, cost of return of upgrading the equipment) - (2hr lecture)
- New Equipment procurement-(Compability and return on investment) - (2hr lecture)
- Integration and compatibility- (2hr lecture)

#### Skill Gap Analysis - (1hr lecture)

#### Laboratory activities (20hr practical)

- Considerations and benefits of SCADA systems
- System reliability and availability

- Monitor and control of a PAC system
- The twelve golden rules for SCADA implementation
- Cyber security best practices.
- Data acquisition through industrial ethernet
- Alarm management through SCADA
- Automatic generation of reports for process performance evaluation

### Teaching and Learning Strategy

This module will be delivered in a blended mode with 1 hr online lecture per week to cover the theory on data architecture and associated technologies. The practical classes will concentrate on developing a SCADA system.

TL strategies used in this module include:

**Direct-instruction strategy:** e.g. online synchronous lectures;

**Activity-based strategy:** e.g. practice various techniques or prove concepts during practical activities; repeat an activity, review and feedback; individual projects; case studies

**Cooperative strategy:** e.g. facilitated group work to critically explore, formulate and communicate ideas, interpretations and conclusions;

**ICT-based strategy:** use of a virtual learning environment (Moodle) for interactive activities, information storage and assessment (quizzes); use software in class; use of various tools for feedback and formative assessment (e.g. Socrative, Padlet); use of Microsoft Teams for synchronous lectures delivery and for group work in breakout rooms

**Independent learning strategy:** e.g. directed study, flipped classroom

**Critical thinking-skills strategy:** e.g. problem-solving; creative thinking.

### Assessment Strategy

The assessment strategy will include online quizzes, practical evaluations and a report where students will discuss aspects of the data architecture of their company and propose improvement.

### Repeat Assessment Strategies

Students can resubmit their report and a practical repeat assessment will be offered.

### Indicative Coursework and Continuous Assessment:

100 %

Form	Title	Percent	Week (Indicative)	Learning Outcomes
Written Report/Essay	Data architecture analysis	30 %	End of Term	1,2,3,5
Multiple Choice/Short Answer Test	Online quizzes	20 %	OnGoing	1,2,3,5
Practical Evaluation	End of term practical assessment	20 %	End of Term	2,3,4
Practical Evaluation	Programming and Troubleshooting	30 %	OnGoing	2,3,4

### Full Time Delivery Mode:

3.00 Hours

Type	Description	Location	Hours	Frequency	Weekly Avg
Lecture	Online lecture	Online	1	Weekly	1.00
Practical / Laboratory	Practical	Engineering Laboratory	2	Weekly	2.00
Independent Learning	Independent Learning	Not Specified	4.5	Weekly	4.50

### Blended Delivery Mode:

3.00 Hours

Type	Description	Location	Hours	Frequency	Weekly Avg
Lecture	Online lecture	Online	1	Weekly	1.00
Practical / Laboratory	Practical	Laboratory	2	Weekly	2.00
Independent Learning	Independent Learning	Not Specified	4.5	Weekly	4.50

### Required Reading Book List

Singh, J., (2015). *PLC And SCADA*. ISBN 9351382427 ISBN-13 9789351382423

McCrary, G., (2013). *Designing SCADA Application Software*. Elsevier. ISBN 9780124170353 ISBN-13 0124170358

Tupper, C., (2011). *Data Architecture*. Morgan Kaufmann Pub.  
ISBN 0123851262 ISBN-13 9780123851260

, E., Kott, A., (2016). *Cyber-security of SCADA and Other Industrial Control Systems* . Springer.  
ISBN 9783319321257 ISBN-13 3319321250

Rieger, C., Ray, I., Zhu, Q., Haney, A., (2019). *Industrial Control Systems Security and Resiliency* . Springer Nature.  
ISBN 9783030182144 ISBN-13 3030182142

Ackerman, P., (2021). *Industrial Cybersecurity - Second Edition*. Packt Publishing.  
ISBN 1800202091 ISBN-13 9781800202092

#### **Programme Membership**

GA\_EADMG\_L08 202400 Higher Diploma in Engineering in Automation and Digital Manufacturing  
GA\_EADMG\_H08 202400 Bachelor of Engineering (Honours) in Automation and Digital Manufacturing  
GA\_EAMFG\_H08 202400 Bachelor of Engineering (Honours) in Automation and Digital Manufacturing  
GA\_EAMSG\_H08 202400 Bachelor of Engineering (Honours) in Advanced Manufacturing Systems  
GA\_SMOEG\_I08 202400 M-C Programme (Mechanical Engineering Department L8)