Module specification

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Module Code	ENG5AJ
Module Title	Modern Manufacture, Sustainability & Industry 4.0
Level	5
Credit value	20
Faculty	FAST
HECoS Code	100209
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Production Engineering	Core
BEng (Hons) Industrial Engineering Design (Mechanical)	Core
BEng(Hons) Industrial Engineering Design (Electrical & Electronic)	Core
BEng (Hons) Low Carbon Energy, Efficiency and Sustainability	Core
FdEng Industrial Engineering (Mechanical) FdEng Industrial Engineering (Manufacturing and Production) FdEng Industrial Engineering (Electrical and Automation)	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	30 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	0 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**30** hrs
Placement / work based learning	0 hrs

Learning and teaching hours	30 hrs
Guided independent study	170 hrs
Module duration (total hours)	200 hrs

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Initial approval date	11/09/2019
With effect from date	11/09/2019
Date and details of revision	30/01/20 admin update of derogation 05/08/20 addition to FdEng Industrial Engineering as optional module Approved on 21/09/20 for addition of BEng Low Carbon Energy, Efficiency and Sustainability Oct 21 minor modification to LO wording through the revalidation and template update Sept 2022 – Addition of FdEng Industrial Engineering programmes
Version number	5

Module aims

The aims of the modules are:

- To create a coherent, lean and sustainable production system;
- To build a culture to support excellence and relentless improvement;
- To apply appropriate methodologies for transforming your facility to lean manufacturing;
- To use QA rules in engineering manufacturing industries;
- To understand and implement Design for Manufacture and Assembly (DFMA) methodologies
- To introduce the student to the principles of Industry 4.0 and the current trend of automation, smart sensors and data exchange in manufacturing.

Module Learning Outcomes - at the end of this module, students will be able to:

1	Examine the common principles of lean manufacturing and how the implementation of a lean production system contributes to business success.
2	Show a systematic understanding of how automation and robotics can be used in modern manufacture.
3	Identify how industry 4.0 can use disruptive technologies to advance production and assembly methodologies.
4	Demonstrate familiarity with sustainable design and manufacturing methods in implementing low carbon energy systems

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: F7, F11, F13 &F14 for FdEng programmes and C7, C11, C13 & C14 for BEng degree apprenticeship programmes.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: An individual report in 2 sections in which interpretation, specification, design, prototyping and manufacturing of a typical basic mechanism widely used in mechanical engineering are presented first then followed by an investigation on how Industry 4.0 practices could be used to further improve the design.

Assessment 2: A Work based case study investigation including Lean Manufacture and assembly, problem solving methods and sustainability (including end of life product) are presented.

It is anticipated that the second assessment when possible would include the redesign of a system or part of a system used in the workplace by the student.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	3	Written Assignment	50
2	1,2,4	Written Assignment	50

Derogations

A derogation from regulations has been approved for this module which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Learning and Teaching Strategies

The module will be delivered through detailed presentations combined with intermittent interactive sessions to enhance students' learning.

The learning experience will be further supported by tutorials and self-study work.

Case studies will be the backbone of the learning experience: Wherever possible real industrial problems will be used as an analysis subject.

Presentations and reports are designed to develop the involvement of the students in the module and develop their sense of inquisition.

Indicative Syllabus Outline

Global engineering strategy: Principles and practice of industrial economics in the global economy. Key characteristics of modern manufacturing industries and change driving factors.

Manufacturing: Range of materials, technologies and processes involved in current best practice manufacturing. Selection and optimisation methods in manufacturing processes (including forming and joining. Plastic deformation processes (lamination, bending).Material processing methods and mechanisms of materials degradation, product design improvement. Future trends in manufacturing and materials awareness.

Manufacturing systems engineering: SMED (Single-Minute Exchange of Dies) and time reduction. Theory of constraints, and methods for line balancing for cycle time reduction.

Engineering operations management / lean manufacture: Operational systems analysis, Industrial processing and manufacturing systems management and maintenance. DFM (Design For Manufacture) methods and evaluation. Product maturity level benchmarking. Optimisation of operations and resources. Risk, opportunities, cost, environmental issues, and fitness for purpose assessment.

Quality Assurance: Measurement and metrology (Measurement System Analysis) concepts and application, D&T for purpose (function and cost). Statistical process control techniques (SPC) VS quality level. TQM (Total Quality Management) within engineering context. Instrumentation techniques to measure product and process performance. Quality procedures using QA techniques, including Failure Mode and Effect Analyses (FMEA), Production Part Approval Process (PPAP), Advanced Product Quality Planning (APQP). National and international QA standards (ISO 9000/9001, ISO14000 and TS 16949). Lean Manufacturing tools and Six Sigma methodology.

Industry 4.0 : Drivers and enablers of I4.0, the stages of the industrial revolutions, smart factories, IoT (Internet of Thing) and IIoT (Industrial Internet of Things). Data Science leading to data-driven decisions and automation. Collaborative robots in industrial contexts, smart automations, products and services. Getting ready for I4.0 and cybersecurity in engineering.

Industrial Engineering: Lean production techniques and design of production systems, time standards in manufacturing. Evaluation and prediction of the effect of learning on the cycle time of repetitive work.

Sustainable manufacturing: Drivers of, and barriers to, sustainable manufacturing. Sustainability and how businesses may respond to the sustainability challenge. Design for disposal or reuse (end-of-life), Toxic chemicals or other hazardous substances disposal considerations.

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update. Please *ensure correct referencing format is being followed as per University Harvard Referencing Guidance.*

Essential Reads

J. K. Liker and G. Trachilis, *Developing Lean Leaders at All Levels: A Practical Guide*. Winnipeg: Lean Leadership Institute Publications*, 2014.*

Other indicative reading

A. Gilchrist, *Industry 4.0: The Industrial Internet of Things*. New York: Apressa, 2016.

J. Morgan and J. K. Liker, *The Toyota Product Development System: Integrating People, Process and Technology*. New York: Productivity press Subhas, 2006.

S. C. Mukhopadhyay, *Internet of Things: Challenges and Opportunities (Smart Sensors, Measurement and Instrumentation*). Springer, 2014.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

Core Attributes
Engaged
Enterprising
Creative
Ethical

Key Attitudes
Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets
Digital Fluency
Organisation
Leadership and Team working
Critical Thinking
Emotional Intelligence
Communication