

Unit 14: Production Engineering for Manufacture

Unit code H/615/1488

Unit level 4

Credit value 15

Introduction

All of the manufactured products we use in our daily lives, from processed food to clothing and cars, are the result of production engineering. Production engineers need to have a comprehensive knowledge and understanding of all the possible production technologies available, their advantages and disadvantages, the requirements of the production system operation and the interaction between the various components of the production system.

This unit introduces students to the production process for key material types; the various types of machinery used to manufacture products and the different ways of organising production systems to optimise the production process; consideration of how to measure the effectiveness of a production system within the overall context of the manufacturing system; and an examination of how production engineering contributes to ensuring safe and reliable operation of manufacturing.

On successful completion of this unit students will be able to illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system. They will be able to select the most appropriate production processes and associated facility arrangements for manufacturing products of different material types and design a production system incorporating a number of different production processes.

Learning Outcomes

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

1. Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system.
2. Select the most appropriate production processes and associated facility arrangements, for manufacturing products of different material types.
3. Analyse how a production system can incorporate a number of different production processes for a given product or assembly.
4. Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system.

Essential Content

LO1 **Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system**

Production engineering activities:

Common practices for manufacturing

Research and develop tools, processes, machines, and equipment

Integrate facilities and systems for producing quality products

Design, implement and refine products, services, processes and systems

Combination of manufacturing technology and management science

LO2 **Select the most appropriate production processes and associated facility arrangements, for manufacturing products of different material types**

Production processes:

Common ceramics, composite, metals manufacturing processes

Bonding and jointing technologies, including welding, adhesives, snap fits, interference fits and mechanical assemblies

LO3 Analyse how a production system can incorporate a number of different production processes for a given product or assembly

Function of the range of production facilities within a manufacturing plant:

Production design for manufacture and assembly

Cellular and flexible manufacturing systems

Component production using CNC machining centres and automated production processes

Automated materials handling equipment, conveyor systems, automatic guided vehicle servicing, product assembly and production lines

Heat treatment facilities, paint and coating plants

Warehouse, stock storage equipment

The purpose, operation and effects of incorporating concepts such as lean manufacturing and just-in-time (JIT) supply to the production process

LO4 Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system

Production systems:

Production performance criteria, through-put rates, yield rates, cost effectiveness, sustainability, flexibility and reliability

Optimising supply chain performance and management

Essential collaboration between manufacturer, supplier and retailer

Production errors and rectification:

Cost in terms of time, material waste, product recall, reputation and litigation

Production data collection, critical evaluation and analysis

The human component:

Cultural openness to new ideas and continuous improvement

Collaboration and information sharing

Performance management and rewards

Engineer training and development practices

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
<p>LO1 Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system</p>		<p>D1 Analyse how the production engineer supports the development of operational strategies to achieve production and financial objectives</p>
<p>P1 Describe the multiple elements of a modern manufacturing system</p> <p>P2 Explain the role of the production engineer within a manufacturing system</p>	<p>M1 Investigate how the production engineer can influence the design process and refine products, services and systems</p>	
<p>LO2 Select the most appropriate production processes and associated facility arrangements for manufacturing products of different material types</p>		<p>D2 Evaluate how the choice of bonding and jointing processes influence both the product design and the selection of the most effective production process</p>
<p>P3 Examine the properties and applications of ceramic products manufactured using the sintering, hot pressing, chemical vapour deposition (CVD) and reaction bonding processes</p> <p>P4 Describe the properties and applications of composite products manufactured using manual and automated layup, filament winding, pultrusion and resin transfer moulding processes</p>	<p>M2 Discuss the benefits associated with polymer manufacturing process</p>	

Pass		Merit	Distinction
LO3 Analyse how a production system can incorporate a number of different production processes for a given product or assembly		M3 Explain how materials, components and sub-assembly handling and conveyance can impact on the effectiveness and efficiency of a modern manufacturing plant	D3 Analyse the relationship of just-in-time (JIT) and lean manufacturing to total quality and world-class manufacturing and their effects on production processes for a given product or assembly
P5 Review the type and sequence of production processes a product or component would follow from initial design through to manufacture and distribution	P6 Describe the function of the various production facilities within a modern manufacturing plant		
LO4 Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system		M4 Explain the immediate and long term effects that production errors and rectification can have on a manufacturing company	D4 Analyse the criteria by which production performance can be measured within the wider manufacturing system
P7 Review the type of data that would be collected and analysed to measure production performance	P8 Describe the measures that can improve production performance criteria		

Recommended Resources

Textbooks

KALPAKJIAN, S. and SCHMID, S. (2009) *Manufacturing Engineering and Technology*. 6th Ed. Prentice Hall.

Websites

<https://www.khanacademy.org/> Khan Academy
(Tutorials)

Links

This unit links to the following related units:

Unit 23: Computer Aided Design and Manufacture (CAD/CAM)

Unit 48: Manufacturing Systems Engineering