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

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<thead>
<tr>
<th>Pass</th>
<th>Merit</th>
<th>Distinction</th>
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<tbody>
<tr>
<td><strong>LO1</strong> Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system</td>
<td><strong>D1</strong> Analyse how the production engineer supports the development of operational strategies to achieve production and financial objectives</td>
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<td><strong>P1</strong> Describe the multiple elements of a modern manufacturing system</td>
<td><strong>M1</strong> Investigate how the production engineer can influence the design process and refine products, services and systems</td>
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<td><strong>P2</strong> Explain the role of the production engineer within a manufacturing system</td>
<td><strong>P3</strong> Examine the properties and applications of ceramic products manufactured using the sintering, hot pressing, chemical vapour deposition (CVD) and reaction bonding processes</td>
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<td><strong>LO2</strong> Select the most appropriate production processes and associated facility arrangements for manufacturing products of different material types</td>
<td><strong>M2</strong> Discuss the benefits associated with polymer manufacturing process</td>
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<tr>
<td><strong>P3</strong> Examine the properties and applications of ceramic products manufactured using the sintering, hot pressing, chemical vapour deposition (CVD) and reaction bonding processes</td>
<td><strong>P4</strong> Describe the properties and applications of composite products manufactured using manual and automated lay-up, filament winding, pultrusion and resin transfer moulding processes</td>
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<td>LO3</td>
<td>Analyse how a production system can incorporate a number of different production processes for a given product or assembly</td>
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<td>P5</td>
<td>Review the type and sequence of production processes a product or component would follow from initial design through to manufacture and distribution</td>
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<td>P6</td>
<td>Describe the function of the various production facilities within a modern manufacturing plant</td>
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<td>LO4</td>
<td>Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system</td>
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<td>P7</td>
<td>Review the type of data that would be collected and analysed to measure production performance</td>
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<td>P8</td>
<td>Describe the measures that can improve production performance criteria</td>
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<td>M3</td>
<td>Explain how materials, components and sub-assembly handling and conveyance can impact on the effectiveness and efficiency of a modern manufacturing plant</td>
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<td>M4</td>
<td>Explain the immediate and long term effects that production errors and rectification can have on a manufacturing company</td>
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<td>D3</td>
<td>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</td>
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<td>D4</td>
<td>Analyse the criteria by which production performance can be measured within the wider manufacturing system</td>
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Recommended Resources

Textbooks

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