

Unit 304

The technology of advanced manufacturing processes

Unit summary

This unit is about recently developed modern manufacturing technologies and processes.

Aims

To provide the candidate with the knowledge and understanding required in the integration of the design of a product, its manufacture and associated commercial considerations. The candidate will be able to choose the most appropriate technology for a manufacturing system.

Prerequisites

It is expected that candidates will have a suitable knowledge of engineering materials, manufacturing processes and CNC techniques consistent with successful completion of the Graduate Diploma examination subject 9107-226 The technology of manufacturing processes.

Learning outcomes

There are **four** outcomes to this unit. The candidate will be able to:

- Assess product design for most suitable manufacturing processes
- Apply modern technologies to the manufacture of products
- Determine process parameters for given conditions
- Apply modern manufacturing strategies in various industries

Guided learning hours

It is recommended that 300 hours should be allocated for this unit. 120 of those hours are actual taught hours. This may be on a full time or part time basis.

Key Skills

This unit contributes towards the Key Skills in the following areas:

KS5.1

Explore the demands of the work and formulate viable proposals for meeting these demands.

KS5.2

Plan to manage the work, and meet your own skill-development needs, and gain the necessary commitment from others.

KS5.3

Manage the work, adapting your strategy as necessary to resolve at least **two** complex problems and achieve the quality of outcomes required. Formally review, with an appropriate person, your use of skills in:

- communication;
- problem solving;
- working with others.

KS5.4

Evaluate your overall performance and present the outcomes, including at least:

- **one** formal, oral presentation of the outcomes from the work;
- **one** written evaluation of your overall approach and
- application of skills.

Occupational Standards

This unit has been mapped to the following National Occupational Standards:

- 1.1.1 Identify the requirements of clients for engineering products or processes
- 1.1.2 Produce specifications for engineering products or processes
- 1.3.1 Undertake research into engineering products or processes
- 1.3.2 Evaluate the results of research
- 1.4.4 Evaluate designs for engineering products or processes
- 2.1.1 Determine the production requirements of engineering products and processes
- 2.1.2 Specify production methods and procedures to achieve production requirements
- 2.1.4 Schedule production activities to implement the production methods and procedures
- 2.2.1 Implement production methods and procedures
- 2.2.2 Solve production problems with engineering solutions
- 2.3.1 Monitor the production process
- 2.3.2 Evaluate the production process
- 3.1.1 Determine the installation requirements for engineering products or processes
- 3.1.2 Specify installation methods and procedures to achieve installation requirements
- 3.1.4 Schedule installation activities to implement the installation methods and procedures
- 3.2.1 Implement installation methods and procedures
- 3.2.2 Solve installation problems with engineering solutions
- 3.3.1 Monitor the installation process
- 3.4.2 Configure engineering products or processes
- 4.1.1 Determine the operational requirements of engineering products or processes
- 4.1.2 Specify operational methods and procedures to achieve operational requirements
- 4.1.3 Schedule operational activities to implement the operational methods and procedures
- 4.2.2 Solve operational problems with engineering solutions
- 4.3.2 Evaluate operational processes
- 5.1.1 Determine the maintenance requirements of engineering products or procedures
- 5.1.2 Specify maintenance methods and procedures to achieve maintenance requirements
- 5.1.3 Schedule maintenance activities to implement the maintenance methods and procedures
- 5.2.2 Solve maintenance problems with engineering solutions
- 5.3.2 Evaluate maintenance processes
- 6.1.1 Analyse the risks arising from engineering products and processes
- 6.1.2 Specify methods and procedures to reduce risks
- 6.2.1 Assure the quality of engineering products or processes
- 6.2.2 Identify the reasons for quality assurance problems
- 6.2.3 Implement improvements to the quality of engineering products or processes
- 7.2.3 Evaluate projects
- 8.1.1 Maintain and develop own engineering expertise

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Outcome 1

Assess product design for most suitable manufacturing processes

Knowledge requirements

The candidate knows how to:

- 1 assess the implication of design on
 - a traditional manufacturing methods
 - b modern advanced manufacturing methods
- 2 correlate the interrelationship between design, component manufacture and product assembly
- 3 analyse production machining systems
- 4 analyse constraints affecting system performance
- 5 determine and analyse manufacturing systems operating parameters
- 6 assess performance, accuracy and quality requirements

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Outcome 2

Apply modern technologies to the manufacture of products

Knowledge requirements

The candidate knows how to:

- 1 determine the most appropriate machining processes and techniques to product manufacture
 - a material removal rate
 - b surface finish
 - c accuracy
 - d economics
- 2 apply reverse engineering with regard to
 - a rapid modelling (prototyping)
 - b concept modelling
 - c functional prototyping
- 3 analyse data generation from models
- 4 apply time compression technologies to manufacturing

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Outcome 3

Determine process parameters for given conditions

Knowledge requirements

The candidate knows how to:

- 1 assess the performance of high-speed machining techniques with regard to
 - a material removal rate
 - b surface finish requirements
 - c accuracy
 - d economic considerations
- 2 assess the effect of tool manufacture, materials and coatings on
 - a performance
 - b tool life
 - c component quality
- 3 determine optimum cutting tool performance in high precision machining techniques
 - a micro-machining
 - b three and five axis machining
 - c “single-hit” machining
- 4 integrate machining techniques for increased production flexibility
- 5 assess and apply industrial lasers technology
 - a cutting
 - b welding
 - c surface treatments
 - d in-process sensing systems
 - e automation
- 6 assess the influence of machining systems on the accuracy and surface generation of components (metrology) using
 - a in-line and off-line measurements
 - b contact and non-contact technologies
 - c co-ordinate measuring systems

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Outcome 4

Apply modern manufacturing strategies in various industries

Knowledge requirements

The candidate knows how to:

- 1 evaluate manufacturing processes and apply them to a minimum of **two** of the following
 - a mechanical production applications
 - b aeronautical engineering applications
 - c chemical engineering applications
 - d automobile engineering applications
- 2 assess the economic considerations of advanced manufacturing
 - a product redesign
 - b manufacturing facilities
 - c time to market
 - d workforce training

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Recommended reading list

Core text	Author(s)	Publisher	ISBN
Implementing Six Sigma: Smarter Solutions Using Statistical Methods	Breyfogle	John Wiley & Sons Inc	0471265721
Automation, Production Systems and Computer Integrated Manufacturing	Groover	US Imports & PHIPes	0130546100
Design for Manufacturing and Assembly: Concepts, Architectures and Kluwer Academic Publishers		Chapman, Hall	0412781905
Laser Metrology and Machine Performance: VI	Ford, DG	WIT Press	1853129909
Materials and Processes in Manufacturing	DeGarmo	John Wiley	0471429449
Metal Cutting and High Speed Machining	Dudzinski, Molinari	Schulz Kluwer Academic/Plenum	0306467259
Product Design for Manufacture and Assembly	Boothroyd, Dewhurst, Knight	Marcel Dekker	082470584X
Rapid Manufacturing: The Technologies and Applications of Rapid	Pham, Dimov	Springer-Verlag UK	185233360X
Rapid Prototyping and Manufacturing: Fundamentals of Stereo Lithography Jacobs, P Society of	Jacobs	Society of Manufacturing Engineers	0872634256
Laser Material Processing	Steen	Springer-Verlag Berlin	o/p
Statistical Process Control: A Practical Guide	Oakland	Butterworth-Heinemann	0434914762 o/p