

Unit 221

Analysis and design of manufacturing systems

Unit summary

This unit is about the methods used for the analysis and design of manufacturing systems.

Aims

The unit aims to furnish the candidate with the knowledge and techniques used to analyse manufacturing systems and apply analytical techniques to solve problems associated with manufacturing activities.

Prerequisites

It is expected that the candidates will have a working knowledge of the materials in the four compulsory papers of the Certificate examinations.

Learning outcomes

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

- Describe business strategy in the analysis and design of manufacturing systems
- Apply modelling and representation to manufacturing systems
- Analyse the design of manufacturing systems
- Apply performance criteria to manufacturing systems

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:

N4.1

Develop a strategy for using application of number skills over an extended period of time.

N4.2

Monitor progress and adapt your strategy, as necessary, to achieve the quality of outcomes required in work involving:

- deductive and inferential reasoning;
- algebraic manipulation.

N4.3

Evaluate your overall strategy and present the outcomes from your work, including use of charts, diagrams and graphs to illustrate complex data.

C4.1

Develop a strategy for using communication skills over an extended period of time.

C4.2

Monitor progress and adapt your strategy, as necessary, to achieve the quality of outcomes required in work involving:

- **one** group discussion about a complex subject;
- **one** extended written communication about a complex subject.

C4.3

Evaluate your overall strategy and present the outcomes from your work, using at least one formal oral presentation, including the use of two images to illustrate complex points.

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
- 1.2.1 Identify and define areas of research
- 1.4.1 Establish a design brief for engineering products or processes
- 1.4.2 Develop a strategy for the design process
- 1.4.3 Create designs for engineering products or processes
- 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
- 2.2.2 Solve production problems with engineering solutions
- 3.1.1 Determine the installation requirements for engineering products or processes
- 3.1.2 Specify installation methods and procedures to achieve installation requirements
- 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
- 4.3.1 Determine the operational requirements of engineering products or processes
- 4.3.2 Specify operational methods and procedures to achieve operational requirements
- 5.1.1 Determine the maintenance requirements of engineering products or procedures
- 5.1.2 Specify maintenance methods and procedures to achieve maintenance requirements
- 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
- 6.2.3 Implement improvements to the quality of engineering products or processes
- 7.1.1 Develop objectives for projects
- 7.2.3 Evaluate projects
- 8.1.1 Maintain and develop own engineering expertise

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Outcome 1

Describe business strategy in the analysis and design of manufacturing systems

Knowledge requirements

The candidate knows how to:

- 1 compare manufacturing systems in a minimum of THREE industrial sectors
 - a economic characteristics
 - b value added activities
 - c productivity indices
 - d innovation
 - e engineering for manufacture (EFM)
 - f managing the design process
- 2 assess corporate, business unit and process strategies
 - a speed of response
 - b product and process flexibility
 - c cost minimisation
 - d capabilities and synergy
 - i R and D
 - ii design
 - iii manufacturing
 - iv management and sales
- 3 undertake an audit of manufacturing activities and process capabilities
- 4 assess make-or-buy decisions

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Outcome 2

Apply modelling and representation to manufacturing systems

Knowledge requirements

The candidate knows how to:

- 1 identify systems and sub-systems
- 2 understand concepts of structured design methods
 - a input-output models
 - b flow diagrams
 - c material mapping
 - d information flows
- 3 understand soft system methodologies and their applications
- 4 assess steady state and dynamic models
 - a system delays
 - b queuing and distribution
 - c continuous and discrete mathematical modelling methods
- 5 implement simulation, discrete event and Monte Carlo methods of modelling/representation
- 6 use empirical data
- 7 test production schedules
- 8 apply and appraise computer simulation and virtual reality modelling

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Outcome 3

Analyse the design of manufacturing systems

Knowledge requirements

The candidate knows how to:

- 1 analyse design and production classification
 - a jobbing
 - b batch line
 - c Detroit automation
 - d cellular manufacture
 - e flexible manufacture systems (FMS)
 - f group technology (GT)
 - g single minute exchange of dies (SMED)
 - h just-in-time (JIT)
- 2 assess the criteria for the selection of the above
- 3 undertake sensitivity analysis
- 4 compare and contrast manual and automated design systems
- 5 synchronise information and material flow systems
 - a forecasting methods
 - b ventor networks
 - c information needs of different functional units
- 6 analyse the concepts and elements of computer integrated manufacturing and business management systems
- 7 analyse waste reduction systems
 - a effective design of work
 - b facilities planning
 - c plant layout and materials handling systems
 - d elimination of no-value-added operations

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Outcome 4

Apply performance criteria to manufacturing systems

Knowledge requirements

The candidate knows how to:

- 1 identify performance indices and the business strategy
 - a resource utilisation
 - b customer satisfaction
 - c benchmarking
- 2 assess production and inventory control systems
 - a KANBAN
 - b OPT
 - c MRPII
- 3 assess system capacity and reliability
 - a run-time
 - b delivery performance
 - c work in progress (WIP)
 - d throughout time
- 4 assess maintenance strategies and techniques
 - a Total Productive Maintenance (TPM)
 - b planned maintenance systems

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Recommended reading list

Core texts	Author(s)	Publisher	ISBN
Automation, Production Systems and Computer Integrated	Groover	Longman HE	0130889784
Manufacturing Strategy	Terry Hill	Palgrave	0333762223
Production and Operations Management	Wild	Continuum Publishing	0826451926
Production and Operations Management	Muhlemann, Oakland, Locklear	Prentice Hall	0273032356
World Class Manufacturing The Lessons of Simplicity	Schonberger	Free Press	0029292700
Other useful texts			
Strategic Management	Bowman, Asch	Palgrave	0333387651
The Essence of Business Economics	Nellis, Parker	Pearson Education	0135731305
The Essence of Competitive Strategy	Faulkner, Bowman	Pearson Education	0132914778
The Essence of the Economy	Nellis, Parker	Pearson Education	0133565025
The Essentials of Production and Operations Management Text and Cases	Wild	Continuum Publishing	0304331309
Tutor's Guide for "Production and Operations Management"	Wild	Continuum Publishing	0304335703