

AQA GCSE

Design and
Technology 8552

4

Production techniques and systems

Unit 1
New and emerging
technologies



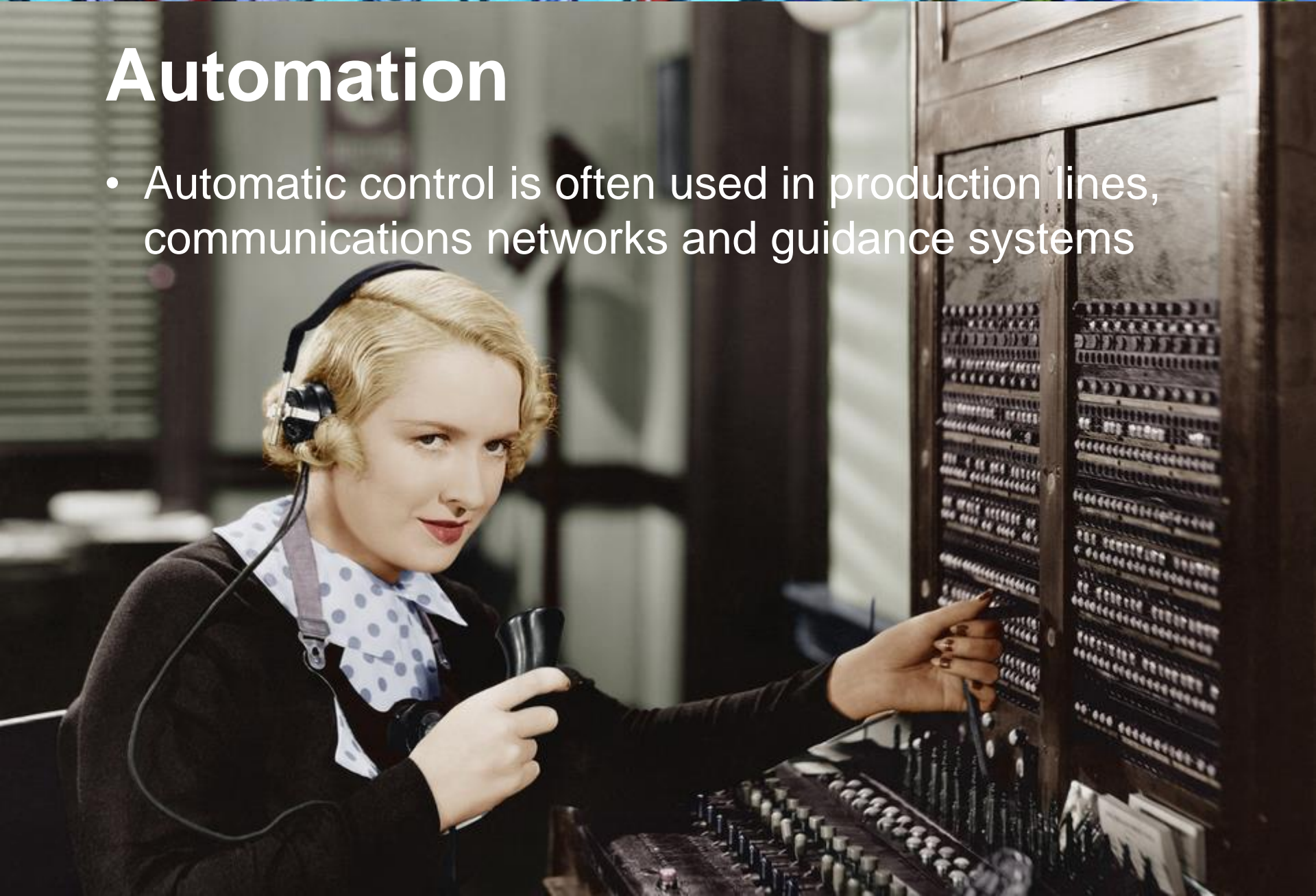
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Objectives

- Understand contemporary and potential future use of automation, Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM)
- Be able to recognise and characterise the use of Flexible Manufacturing Systems (FMS)
- Understand how Just In Time (JIT) and Lean Manufacturing contribute to manufacturing efficiencies

Automation

- Automatic control is often used in production lines, communications networks and guidance systems



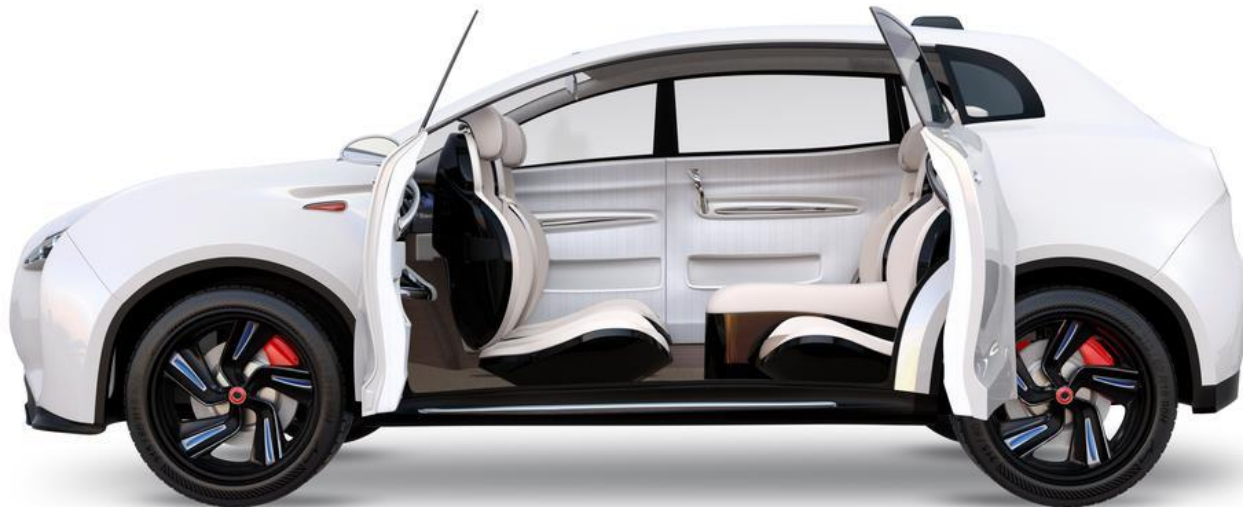
Benefits of automation

- Robots and automated systems often replace manual jobs, and can therefore save labour costs
- What other benefits are there of automation to:
 - Product manufacturers or service suppliers?
 - Consumers?
- What products are still handmade?
 - Why would manufacturers prefer to make things by hand?



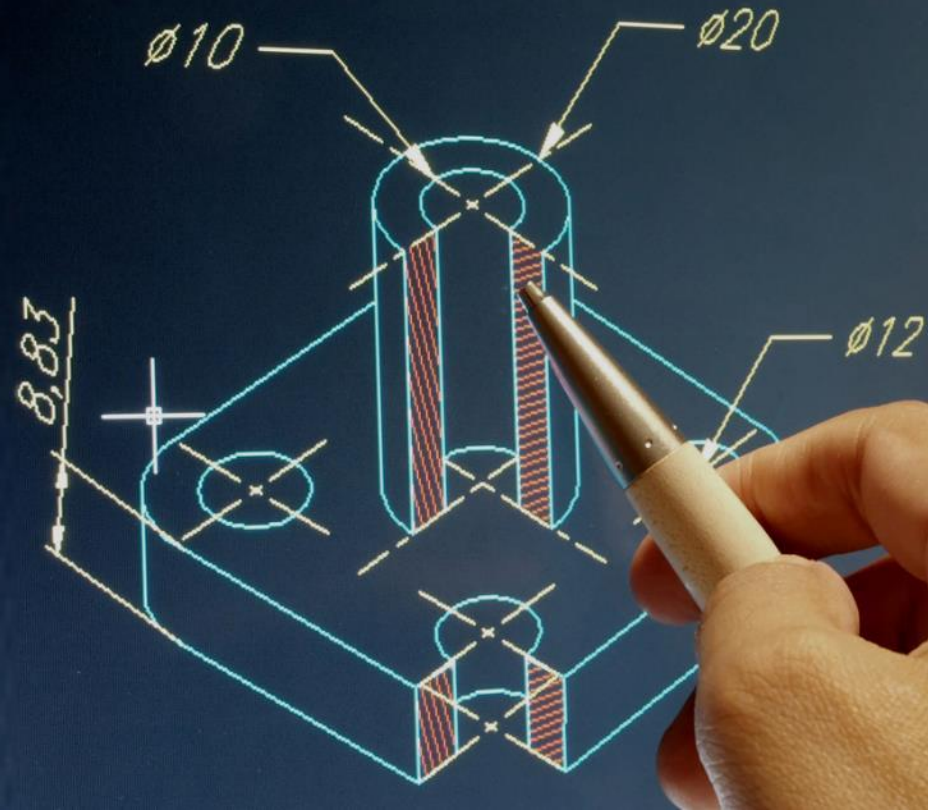
Automated guidance systems

- Some companies including Google are developing autonomous self-driving vehicles
 - How might this improve the lives of the elderly or impaired?
 - What ethical considerations might developers need to make?



Computer Aided Design (CAD)

- CAD software is used to create precision 2D or 3D drawings, models or technical illustrations
- It is commonly used by designers, architects, engineers and artists
 - What are the advantages of CAD over hand drawn designs?
 - Many designers still prefer to start sketching by hand
 - Why?



Advantages and disadvantages

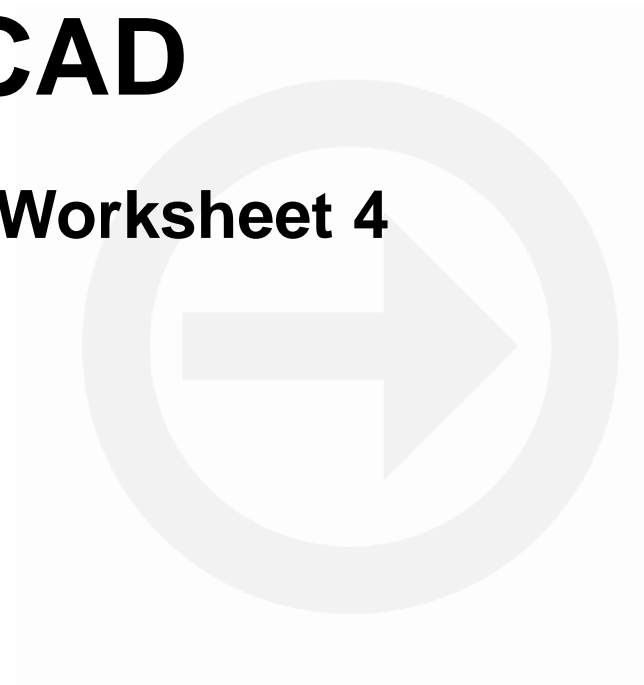
Advantages of CAD

Disadvantages of CAD

Advantages of CAD	Disadvantages of CAD

Automation and CAD

- Complete **Tasks 1 and 2 of Worksheet 4**



Advantages and disadvantages

Advantages of CAD	Disadvantages of CAD
Designs can be created, saved and edited easily, saving time	CAD software is complex to learn
Designs or parts of designs can be easily copied or repeated	Software can be very expensive
Designs can be worked on by remote teams simultaneously	Compatibility issues with software
Designs can be rendered to look photo-realistic to gather public opinion in a range of finishes	Security issues - Risk of data being corrupted or hacked
CAD is very accurate	
CAD software can process complex stress testing	



Computer Aided Manufacture

- Automated machinery is controlled by software to manufacture physical parts
- CAM uses Computer Numerical Control (CNC) and CAD files to generate 3D tool paths for the machinery to follow
 - CAM machinery includes laser cutters, embroidery machines, CNC milling machines, routers and lathes
 - Where is CAM currently used?



CNC milling

- CNC milling machines work in three dimensions to produce intricately and accurately machined objects such as this jet engine turbine wheel
 - Digital designs are converted into a series of x, y, z coordinates for the machine to follow



CNC laser cutting

- By cutting at different speed rates, laser cutters can burn through or etch the surface of a material
- They can cut complex shapes in a wide range of materials including:
 - Paper
 - Polymers
 - Timber
 - Metals and
 - Textile based materials



Why use CAM?

- Why are CAM systems becoming increasingly used in industry?
- What are the drawbacks of using CAM to:
 - The organisation?
 - Staff within the organisation?

Flexible Manufacturing Systems (FMS)

- FMS involve an assembly of automated machines commonly used on short-run batch production lines where the products frequently change
- They can be easily:
 - recalibrated
 - reprogrammed
 - retooled



Lean Manufacturing

- 'Lean' is a Japanese philosophy created by Toyota
- It aims to manufacture products just before they are required to eliminate areas of waste including:
 - Overproduction
 - Waiting
 - Transportation
 - Inappropriate processing
 - Excessive inventory
 - Unnecessary motion
 - Defects

Just In Time (JIT) production

- Items are created as they are demanded
- No surplus stock of raw material, component or finished parts are kept
 - What are the benefits of holding no stock?
 - What are the drawbacks of ordering parts as you need them?
 - What are the potential problems of relying on 'just in time' deliveries of materials?
 - How do JIT systems subscribe to the ethos of 'lean' manufacturing?



Advantages and disadvantages

- The advantages of Just in Time manufacturing include:

Advantages of JIT	Disadvantages of JIT
No warehousing costs	Reliant on a high quality supply chain
Ordered secured before outlay on parts is required	Stock is not available immediately off-the-shelf
Stock does not become obsolete, damaged or deteriorated	Fewer benefits from bulk purchasing

Manufacturing techniques

- Complete **Task 3** of **Worksheet 4**



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