



ALIGNED WITH THE 2023-2025 SYLLABUS

CAIE IGCSE

# COMPUTER SCIENCE (0478)

THEORY

# 1. Automated and Emerging Technologies

## 1.1. Automated Systems

- Automated Systems are a combination of software and hardware designed to function without human intervention.
- Process of Automated Systems**
  - Sensors take inputs, and they are sent to the microprocessor. The data is usually analogue, so it has to go through Analogue-to-Digital Converter (ADC)
  - The microprocessor processes the data and makes the necessary decisions based on its program
  - The actions are then executed by the actuators (Motors, wheels and so on)

### Advantages and Disadvantages of Automated Systems

Advantages	Disadvantages
Faster and Safer	Expensive to set up and maintain
Any changes can be identified quickly	Any computerised systems are prone to attacks
Less Expensive in the long run	Over-reliance on automated systems may cause humans to lose skills
Higher Productivity and Efficiency	

**You should be able to describe the advantages and disadvantages of an automated system used for a given scenario.**

Including scenarios from:

- industry
- transport
- agriculture
- weather
- gaming
- lighting
- science

## 1.2. Robotics

- Robotics is the branch of computer science that combines robot design, construction and operation.
- Isaac Asimov's Laws of Robotics -
  - A robot may not injure a human through action or inaction
  - A robot must obey orders given by humans unless it comes into conflict with Law 1
  - a robot must protect itself unless this conflicts with either law 1 or 2.
- Characteristics of a robot -
  - Ability to sense their surroundings
  - Have a degree of movement
  - Programmable

**NOTE - ROBOTS DO NOT POSSESS AI; THEY TEND TO DO REPETITIVE TASKS RATHER THAN REQUIRING HUMAN CHARACTERISTICS**

- Types of Robots -
  - Independent - Have no human intervention; they can completely replace humans
  - Dependent - Needs human intervention through an interface, can supplement but can't completely replace humans

### Advantages and Disadvantages of Robots

Advantages	Disadvantages
Robots can work 24/7	Robots can find it difficult to do non-standard tasks
Robots can work in hazardous conditions	Robots can lead to higher unemployment
They are less expensive in the long run	Risk of deskilling as robots replace humans in some task
They have high productivity and are more consistent	Expensive to install and maintain in the short run
	Robots have the risk of getting hacked.

## 1.3. Artificial Intelligence

- AI is the branch of computer science that simulates intelligent human behaviour.
- Types of AI -
  - Narrow AI - A machine has superior performance to a human when doing one specific task
  - General AI - A machine is similar to a human when doing one specific task
  - Strong AI - Machine has superior performance to a human in many tasks
- Characteristics of AI -
  - Collection of Data and Rules
  - Ability to Reason
- Ability to learn and adapt

## Types of AI

- **Expert System** - AI that is developed to mimic human knowledge and experiences. They are usually used for answering questions using knowledge and inference.
- They have many applications, including chatbots, diagnosis in the medical industry, financial calculations and so on

### Advantages and Disadvantages of Expert Systems

Advantages	Disadvantages
High level of Expertise	Setup and Maintenance costs are very high
High Accuracy and Consistent	Can only rely on the information in the system
High response times	Tend to give cold responses sometimes

- **Machine Learning is a subset of AI in which machines are trained to learn from** past experiences.

### Difference Between AI and Machine Learning

AI	Machine Learning
Representation of human intelligence in machines	Machines are trained to make decisions without being programmed to
The aim is to build machines that think like humans	The aim is to make machines learn through data acquisitions

# NOTES

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