A1 COMPUTER FUNDAMENTALS · A1.3

Operating systems and control systems

How an **operating system** shares the hardware, schedules the CPU, and handles devices, plus the **control systems** that keep a physical process on target. Multitasking and resource allocation are HL only.

01 Role of the OS

Layer	Sits between apps and the hardware.
Shares	CPU, memory, storage, and devices.
Protects	Keeps each process in its own space.
Examples	Windows, macOS, Linux, Android, iOS.

02 OS functions

Process	Schedules and tracks running processes.
Memory	Allocates RAM, isolates spaces, virtual memory.
File	Organises files and access rights.
Device	Drivers talk to keyboards, disks, printers.
Security	Authentication, permissions, logging.
UI	Desktop or command line.

03 Scheduling algorithms

01
FCFS

First come, first served, in arrival order. Non-preemptive. Simple, but a long job blocks the queue.

02
Round robin

Fixed quantum, rotate the ready queue. Preemptive and fair, keeps the system responsive.

03
Priority

Highest priority runs first. Can starve low-priority jobs unless priorities are adjusted.

04 Polling vs interrupts

Polling

CPU loops, checking each device. Simple but wastes cycles. Good for frequent or predictable events.

Interrupt

Device signals the CPU, which runs an **ISR** then resumes. Efficient for rare or unpredictable events.

Weigh Event frequency, CPU overhead, power, latency.

05 Multitasking · HL only

Context switch Save one process state, load the next.

Virtual memory Run more than fits in RAM.

Paging Move fixed-size pages between RAM and disk.

Contention Processes compete for CPU, memory, files.

Deadlock Each holds what the others need; all stall.

06 Control systems · input, process, output, feedback

Sensor	Measures the current output such as temperature, speed, or position. A transducer converts one form of energy into another.	INPUT
Controller	Compares the measurement to the set point, finds the error, and runs the control algorithm. Usually a microcontroller.	PROCESS
Actuator	A motor, heater, or valve that physically changes the system in response to the controller.	OUTPUT
Feedback	Closed-loop feeds the sensor reading back so the system self-corrects (thermostat). Open-loop has no feedback (timer fan).	LOOP

FINAL PASS BEFORE THE EXAM

Rapid exam tips

Eight things that lose marks in Paper 1 if you slip on them. Skim before you walk in.

01

The OS is more than a **UI**. It also manages processes, memory, files, devices, and security.

02

FCFS is simple but a long job blocks the queue. **Round robin** is fair, not fastest.

03

Preemptive can interrupt a process (round robin). **Non-preemptive** lets it finish (FCFS).

04

Polling loops to check; **interrupts** let a device signal and run an **ISR**.

05

Interrupts are not always better. **Polling** wins for frequent, predictable events.

06

A **sensor** measures input; an **actuator** changes output. Don't swap them.

07

Open-loop has no feedback; **closed-loop** self-corrects with a sensor.

08

Multitasking, virtual memory, paging, and **deadlock** (A1.3.5) are **HL only**.