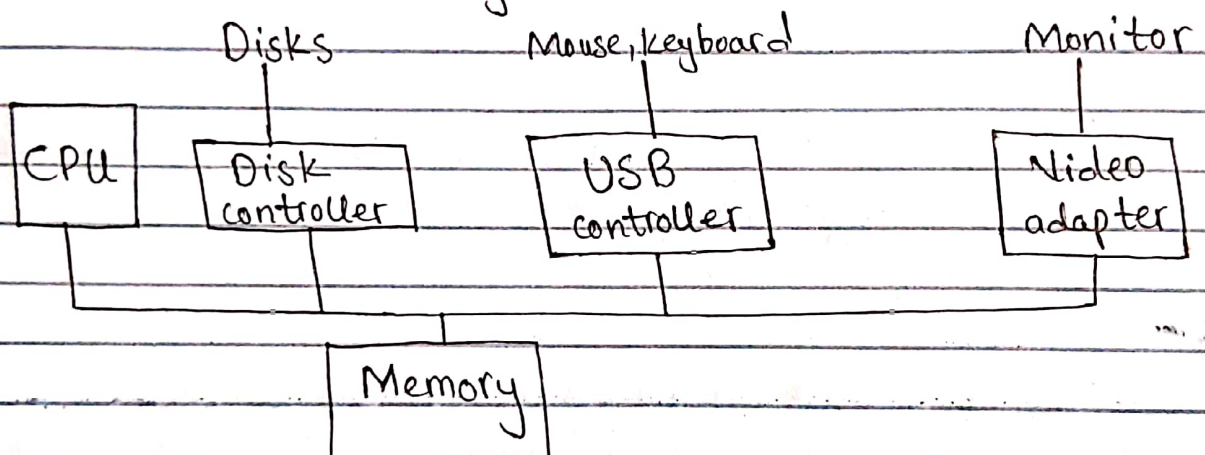# Operating Systems

Device Controller:-

⇒ A general purpose computer system consists of CPUs and multiple device controllers that are connected through a common bus.
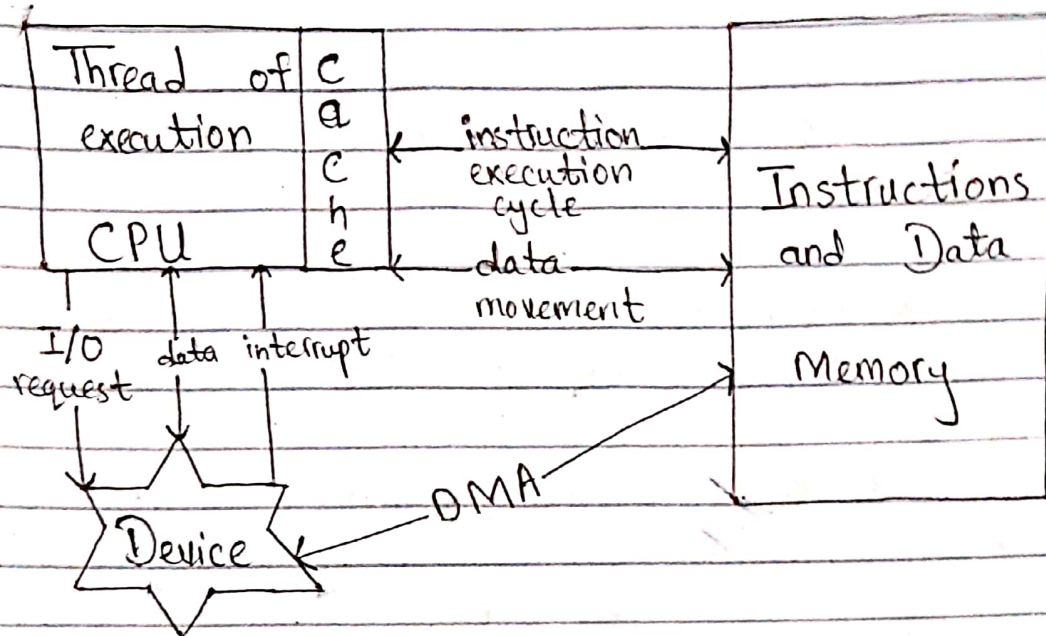
⇒ Device controller maintains local buffer storage and set of special purpose registers.

⇒ Device controllers help in providing access to the shared memory.

⇒ Each device controller is in charge of a specific type of device.

Working of an I/O operation :-

=> To start an I/O operation, the device driver loads the appropriate registers within the device controller.

=) The device controller, in turn, examines the contents of these registers to determine what action to take.

=) The controller starts the transfer of data from the device to its local buffer.

=) Once the transfer of data · is complete, the device controller informs the device driver via an interrupt that it has finished its operation.

=) The device driver then returns control to the operating system.

=> This form of interrupt-driven I/O is fine for moving small amounts of data but can produce high overhead when used for bulk data movement as CPU will be frequently disturbed due to calling of interrupts.

=> In order to remove the above problem, Direct Memory Access (DMA) is used.

=> After setting up buffers, pointers and counters for the I/O device, the device controller transfers an entire block of data directly to or from its own buffer storage to memory, with no intervention by the CPU.

Dual Mode :-

=> In the hardware level, instructions are executed in 2 different modes (Dual mode operations) :-
① User mode / Non-privileged mode
② kernel mode / Privileged mode

=> kernel mode is represented by mode bit 0 while User mode is represented by mode bit 1.

=> The dual mode operation is used in order to provide protection and security to user program.

=) It is purely decision of OS in which particular mode instructions have to be executed.

=) Privilleged instructions are executed in kernel mode and non-privileged instructions are executed in user mode

=) Mode bit is used to identify in which particular mode current instructions are executing.

=) Operating system always runs in kernel mode (Default).

=) In booting time, system always starts in kernel mode.

=) Some of the privileged instructions :-
1) I/O operations
2) Context switching
3) Disabling the interrupts

=) Some of the non-privileged instructions :-
① reading time of clock
② reading status of program
③ sending final print output to printer.