3.4 INTERRUPT SOURCES

Q28. What are the various hardware and software interrupts? Explain.

Ans:

Hardware Interrupts

Hardware interrupts have two sources, internal devices and external peripherals. For various versions of processors and microcontrollers, the internal sources and devices are not same. The hardware interrupts from different sources are as follows.

1. **Internal Hardware Interrupts**

These interrupts are generated by the hardware of internal devices of the system. The devices may be processor, micro-controller or any other internal device of the system.

Examples: Timer over-flow interrupt generated by the hardware of microcontroller, timer capture on input, parallel port, UART serial receiver port, ADC start of conversion, ADC end of conversion, Real Time Clock (RTC) time outs, watchdog timer reset etc.

2. **External Hardware Interrupts**

These interrupts are generated by the hardware of peripherals or devices which are connected externally to the system. The external hardware interrupt sources are of two types,

Type 1: Type-1 external hardware interrupt sources supply ISR address or vector address or information regarding the type of interrupt by using the data bus.

Examples: 'INTR' in 8086 and 80X86 processors.

Type 2: Type-2 external hardware interrupt sources do not provide interrupt or ISR address informations. These interrupts with their corresponding ISR vector addresses act as microcontroller or processor specific interrupts for ongoing program.

Examples: Non-maskable pin [i.e., NMI in 8086 and 80 × 86 processors] maskable pin [i.e., INT0 and INT1 in 8051 micro-controller and IRQ in 68HC11].

Software Interrupts

The software interrupt instructions used to invoke the device functions (i.e., to close, to open) are called software interrupts. The software interrupts from different sources are as follows.

1. Software Error-related Hardware Sources

These interrupts are generated by the hardware of processor. The processors in the system are designed exclusively for particular instruction set. Each processor has its own instruction set. An illegal code is an instruction in the software which does not match with any instructions in the instruction set of processor. In some processors interrupt occurs only when the processor fetches illegal code. These error-related interrupts are also known as hardware-generated software traps (or software exception).

Examples

Division by zero detection (or trap) by hardware, overflow by hardware, illegal opcode by hardware, underflow by hardware.

2. Software Instruction-related Interrupt Sources

These interrupts are generated by the instructions of the software. A single program can deal with specific computational errors, run-time conditions, signalling some condition. Software instructions related to the traps, signals or exceptions are generally provided by the processors. Some software instructions which interrupt the currently running program and divert to the ISR, are known as software handlers. The software handler is used to switch the currently running routine to another routine. Trapping the run time error, execution of exceptional handlers are done by the software instructions.

Examples

Programmer defined exceptions, traps for handling exceptional run-time conditions, signals from device driver functions.