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COLLEGE OF ARTS AND SCIENCE
(AUTONOMOUS)
Accredited by NAAC (Cycle-III) with 'A+' Grade

DEPARTMENT OF COMPUTER APPLICATIONS

Course Name: OPEN ELECTIVE (PC HARDWARE AND TROUBLESHOOTING)

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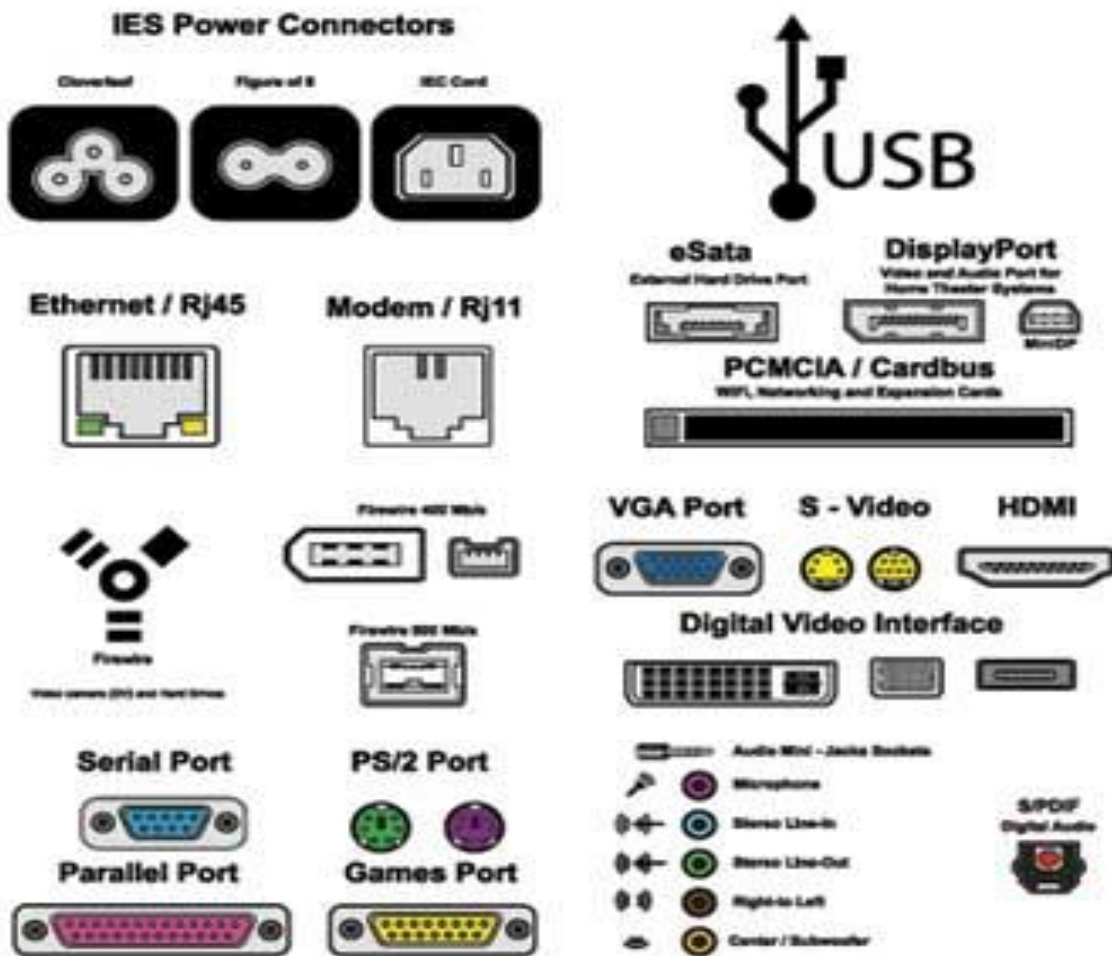
UNIT-II

The motherboard serves as a single platform to connect all of the parts of a computer together. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.



- Features of Motherboard
- A motherboard comes with following features –
- Motherboard varies greatly in supporting various types of components.
- supports a single type of CPU and few types of memories.
- Video cards, hard disks, sound cards have to be compatible with the motherboard to function properly.
- Motherboards, cases, and power supplies must be compatible to work properly together.
- Popular Manufacturers
- Following are the popular manufacturers of the motherboard.
- Intel
- ASUS
- AOpen
- ABIT
- Biostar

- Gigabyte
- MSI
- Characteristics of Ports
- A port has the following characteristics –
- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.



Let us now discuss a few important types of ports –

Serial Port

- Used for external modems and older computer mouse
- Two versions: 9 pin, 25 pin model
- Data travels at 115 kilobits per second

Parallel Port

- Used for scanners and printers
- Also called printer port
- 25 pin model
- IEEE 1284-compliant Centronics port

PS/2 Port

- Used for old computer keyboard and mouse
- Also called mouse port
- Most of the old computers provide two PS/2 port, each for the mouse and keyboard
- IEEE 1284-compliant Centronics port

Universal Serial Bus (or USB) Port

- It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard, etc.
- It was introduced in 1997.
- Most of the computers provide two USB ports as minimum.
- Data travels at 12 megabits per seconds.
- USB compliant devices can get power from a USB port.

VGA Port

- Connects monitor to a computer's video card.
- It has 15 holes.
- Similar to the serial port connector. However, serial port connector has pins, VGA port has holes.

Power Connector

- Three-pronged plug.
- Connects to the computer's power cable that plugs into a power bar or wall socket.

Firewire Port

- Transfers large amount of data at very fast speed.
- Connects camcorders and video equipment to the computer.
- Data travels at 400 to 800 megabits per seconds.
- Invented by Apple.
- It has three variants: 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector, and 9-Pin FireWire 800 connector.

Modem Port

- Connects a PC's modem to the telephone network.

Ethernet Port

- Connects to a network and high speed Internet.
- Connects the network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.

Game Port

- Connect a joystick to a PC
- Now replaced by USB

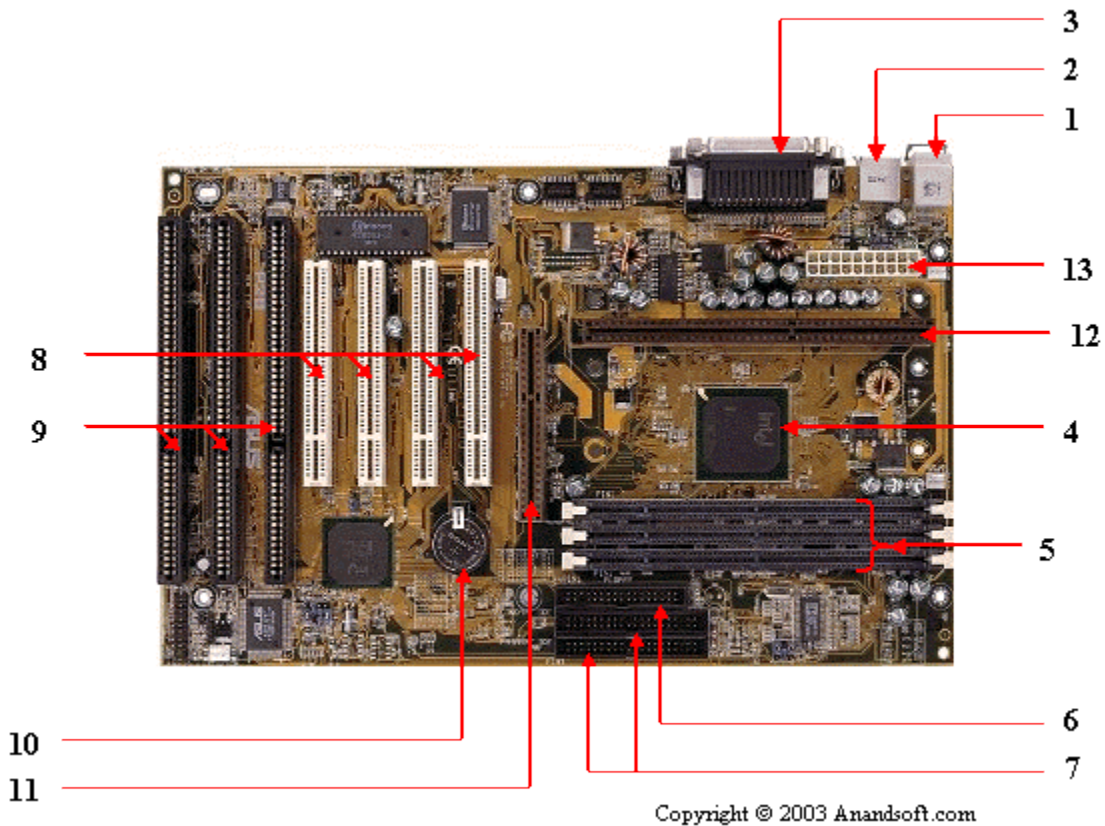
Digital Video Interface, DVI port

- Connects Flat panel LCD monitor to the computer's high-end video graphic cards.
- Very popular among video card manufacturers.

Sockets

- Sockets connect the microphone and speakers to the sound card of the computer.

Components



- 1. Mouse & keyboard
- 2. USB
- 3. Parallel port
- 4. CPU Chip
- 5. RAM slots

- 6. Floppy controller
- 7. IDE controller
- 8. PCI slot
- 9. ISA slot
- 10. CMOS Battery
- 11. AGP slot
- 12. CPU slot
- 13. Power supply plug in
- **1. Mouse & keyboard:** Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard. The oldest, but still quite common type, is a special DIN, and most PCs until recently retained this style connector. The AT-style keyboard connector is quickly disappearing, being replaced by the smaller mini DIN PS/2-style keyboard connector.
- **2. USB (Universal serial bus):** USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers. a USB connector's distinctive rectangular shape makes it easily recognizable.
- **3. Parallel port:** Most printers use a special connector called a parallel port. Parallel port carry data on more than one wire, as opposed to the serial port, which uses only one wire. Parallel ports use a 25-pin female DB connector. Parallel ports are directly supported by the motherboard through a direct connection or through a dangle.
- **4. CPU Chip :** The *central processing unit*, also called the *microprocessor* performs all the calculations that take place inside a pc. CPUs come in Variety of shapes and sizes.
- **5. RAM slots:** Random-Access Memory (RAM) stores programs and data currently being used by the CPU. RAM is measured in units called bytes. RAM has been packaged in many different ways. The most current package is called a 168-pin DIMM (Dual Inline Memory module).
- **6. Floppy controller:** The floppy drive connects to the computer via a 34-pin *ribbon cable*, which in turn connects to the motherboard. A *floppy controller* is one that is used to control the floppy drive.
- **7. IDE controller:** Industry standards define two common types of hard drives: EIDE and SCSI. Majority of the PCs use EIDE drives. SCSI drives show up in high end PCs such as network servers or graphical workstations. The EIDE drive connects to the hard drive via a 2-inch-wide, 40-pin ribbon cable, which in turn connects to the motherboard. *IDE controller* is responsible for controlling the hard drive.

- **8. PCI slot:** Intel introduced the *Peripheral component interconnect* bus protocol. The PCI bus is used to connect I/O devices (such as NIC or RAID controllers) to the main logic of the computer. PCI bus has replaced the ISA bus.
- **9. ISA slot:** (Industry Standard Architecture) It is the standard architecture of the Expansion bus. Motherboard may contain some slots to connect ISA compatible cards.
- **10. CMOS Battery:** To provide CMOS with the power when the computer is turned off all motherboards comes with a battery. These batteries mount on the motherboard in one of three ways: the obsolete external battery, the most common onboard battery, and built-in battery.
- **11. AGP slot:** If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot, but is slightly shorter and usually brown. You also probably have a video card inserted into this slot. This is an Advanced Graphics Port (AGP) slot.
- **12. CPU slot:** To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly. So remember if it does not go easily, it is probably not correct. Be sure to plug in the CPU fan's power.
- **13. Power supply plug in:** The Power supply, as its name implies, provides the necessary electrical power to make the pc operate. the power supply takes standard 110-V AC power and converts into 12-Volt, 5-Volt, and 3.3-Volt DC power.
- **Factors of Motherboard**
- The main form factor for the motherboard is size and shape. The other factors are physical layout, mounting holes, and board organization.
- In the below section, some of the form factors are mentioned below:
- **1. ATX**
- In this type, the standard locations were defined for mouse, keyboard, input/output devices, video connectors, and other devices. In the year 1990, the ATX form factor was developed. The expansion slot given new location as in this form factor expansion slot were given separate space so that they can be connected with the motherboard.
- **2. Micro-ATX**
- The benefit obtained from the Micro-ATX is the same as from the ATX form factor. The main difference is an improvement in system design so that the overall cost of the component can be reduced as the size of the motherboard is reduced in this form factor. The size is reduced by reducing the I/O slots number on the motherboard.

IDE and SATA

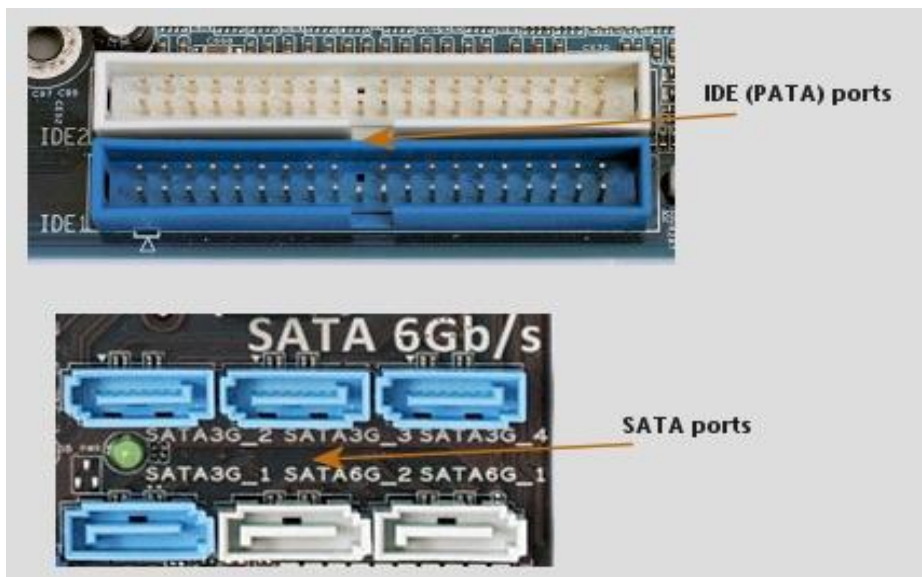
- **IDE** and **SATA** are different types of interfaces to connect storage devices (like [hard drives](#)) to a computer's system bus. **SATA** stands for **Serial Advanced Technology Attachment** (or **Serial ATA**) and IDE is also called **Parallel ATA** or **PATA**. SATA is the newer standard and SATA drives are faster than PATA (IDE) drives. For many years ATA provided the most common and the least expensive interface for this application. But by the beginning of 2007, SATA had largely replaced IDE in all new systems.
- The ATA interface (ATA stands for AT attachment where "AT" refers to [IBM's PC/AT](#) for which it was originally built) evolved in stages from Western Digital's original Integrated Drive Electronics (IDE) interface. After the introduction of Serial ATA in 2003, the original ATA was retroactively renamed Parallel ATA.

- **IDE & SATA Ports**

IDE (PATA), and SATA ports are used to connect storage devices such as Hard Drives, Optical Drives, and Solid State Drives.

IDE (Intergrated Drive Electronics) which is now also called PATA (Parallel Advanced Technology Attachment) was designed in 1986 and is found in older motherboards. You can connect two drives to each port giving you a total of four drives.

SATA (Serial Advanced Technology Attachment) was created in 2003 and supercedes IDE. It is found in newer motherboards and each port can support one drive.



- The picture above show two IDE ports - IDE1 (blue), and IDE2 (white). You would connect your main hard drive which contains the operating system to IDE1 and set it as the primary master. *More details in the [Hard Drive section](#) of this website.*

- The six SATA ports in the picture above have two white high-speed ports (SATA 6Gb/s), and four slower ports (SATA 3Gb/s). You would connect your main hard drive which contains the operating system to the white SATA 6G_1 port particularly if the drive supports this speed

	IDE	SATA
Advantages	Maximum compatibility	Inexpensive, large storage capacity.
Disadvantages	Lacks support for new technology such as native command queuing and hot-plugging hard drives	Lower <u>MTBF</u> than <u>SAS</u> (700,000 hours to 1.2 million hours of use at 25 °C), less suited for servers.
Hot plugging (add/remove component while the computer is running)	IDE interface does not support hot plugging	SATA interface supports hot plugging
Speed	data transfers at the rate of up to 133MB/s	Data transfers at the rate of up to 6 Gb/s
Data cable	Ribbon-like, wide, can be up to 18 inches long	Narrow, can be up to a meter (roughly 3ft) long. Power and data split into two connections.
Lineage	Superseded by <u>SATA</u>	Supersedes Parallel ATA (PATA) aka IDE
Year Created	1986	2003
Jumpers	In a computer system, it's possible to have more than one harddrive. To connect multiple IDE drives, you need to chain the ribbon cables from one to the next. The computer system has no idea which is the main drive, from which to load the OS	SATA drives don't use jumpers. Each drive connects directly to the motherboard. To set the primary drive, you can access the settings from the computers BIOS (special software that runs when you start the computer).

Differences in Cables and Connectors



SATA (right) and IDE (left) hard drives. The SATA hard drive has the data cable on the right and power cable on the left. The IDE data cable is ribbon-like (on the left)

- Hard drives need a cable/connection for data and one for power. Parallel ATA only allows data cable lengths up to 18 in (457 mm) while [SATA](#) allows cable lengths up to 1 m (3.28 ft). eSATA cables can be 2 m in length.
- IDE consists of a 40-pin connector attached to a ribbon cable. 80-pin connectors were also introduced later. The connectors are black in a 40-pin connector while in an 80-pin connector, they come in 3 colors: blue - controller, gray - slave drive, and black - master drive. Each cable has two or three connectors, one connector is attached to the interface that connects to the computer system (mother board) and the others are connected to the drives.

- SATA consists of an 8 mm wide wafer connector on each end and the cable has a 7-pin connector, 3 grounds and 4 active data lines in two pairs. It has the facility to attach only one drive and so Serial ATA does away with Master/Slave configurations.

modem card

- A modem card is an internal type of modem that is plugged into the PCI slot of a PC motherboard. A modem is a communications device that allows a computer to send and receive data through telephone or cable lines.
- Most modern computers connect to a home network, a local area network or the Internet using an external modem or through an Ethernet port or a wireless device such as a USB dongle. However, during the early days of the Internet and before the advent of cable Internet and DSL connection, it was more common to use a modem card, which had to be added to a desktop computer manually, like a video card or sound card. This modem card used a landline telephone to connect to an Internet service provider, a technology known as a "dial-up connection."
- The main problem with modem cards was speed, which was limited to 56 Kbps. Older modems used before the advent of the Internet were even slower and were measured in "baud" rate rather than in bits or bytes per second. Early 1400-baud modems were a standard for sending text to such destinations as online bulletin boards. The use of baud rate had since become obsolete, and the transmission speed of current modems is now measured in megabytes per second.
- **What is a Graphics Card?**
- **Graphics card** is a hardware which is used to increase the video memory of a computer, and make its display quality more high-definition. It makes the computer more powerful and gives it the capacity to do more high-level works. The quality of the image depends on the quality of the graphics card. It is very much important for gaming and video editing on a PC. Every game needs a graphics memory to start and it depends on the type of the game, and the requirements are mentioned on the game box.

Example :

- **Acer predator** –
Nvidia GTX 1050 4GB Graphics Card.
- **Alienware 17** –
Nvidia Geforce GTX 1070 8GB Graphics Card.

- Both computers have a high power graphics card for better performance.
- **GPU :**
- GPU stands for Graphics Processing Unit.
- The power of GPU depend on the model of the GPU.
- The graphics as an external component is attached on a slot known as an expansion slot.
- It is the brain of the graphics card and is what creates the visuals that we see on the monitor.
- **Types of Graphics Card :**
- **Integrated –**
The graphics which are built into the motherboard are known as Integrated, are generally used in most laptops, the cannot be easily upgraded.
- **Discrete –**
It is an external graphics card which is a hardware and added on a motherboard as an extra component. Most people may not need an external graphics card for there work on PC. Basic work like creating files, doing office work, watching movies, listing songs, etc may not need a graphics card. But for the users playing high resolutions games and video editing may need an external component i.e graphics card for there purpose.
- **Features of Graphics Card :**
- **Memory –**
Graphics card carries its own memory. Memory range could be from 128MB to 2GB of memory. We should buy a card with more memory. More RAM equals higher resolutions, more colors on the screen, and the best special effects.
- **Multiple Screen support –**
Most new video cards have the ability to connect two monitors to one card. This feature is very important for video editing and hardcore gamer craves that extra real estate as well. You can either see two separate Desktops or make the two monitors into one Desktop.
- **Gaming And Video Editing –**
The discrete graphics card is not only for a gamer but those who use high-end video editing software also get help as a high-quality graphics card to reduce the rendering time of an image also give a high-def environment.
- **Connection –**
The graphic card is connected to the monitor using many different ports put the port must be present

on both monitor and Graphics card. These are some common ports used to connect graphics card with a monitor. **1. VGA 2. HDMI 3. DVI**

Troubleshooting and Maintaining Motherboards

- The motherboard *is* the computer, so the usual symptom of a failed motherboard is a completely dead system. Fans, drives, and other peripherals may spin up if the motherboard is dead, but more often nothing at all happens when you turn on the power. No beeps, no lights, no fans, nothing.
- If you think you have a dead motherboard, think again. The most likely cause of a dead system is a blown fuse or breaker at the wall receptacle. If you're certain the system is getting power and you have just installed the motherboard, it's much more likely that you've neglected to connect a cable or made some other basic error than that the motherboard itself is bad, assuming of course that the problem motherboard is a high-quality product.
- In a working system, it's very uncommon for a high-quality motherboard to fail other than from lightning damage or other severe abuse. In particular, it's nearly unheard of for a motherboard to fail while it is running, as opposed to when you start the system. A dead system is more often caused by a dead power supply than a dead motherboard, so the first step to troubleshoot an apparently dead motherboard is to swap in a known-good power supply. If the system remains completely dead with a known-good power supply, it's likely that the motherboard is defective and must be replaced.
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Most common motherboard problems and how to fix them

- 1) Not enough power

This problem is easily solved by buying better power supply cables. If that doesn't work, then there may be another hardware issue preventing your system from turning on properly, such as a dead RAM stick or faulty processor.

2) Frequent crashing

- Your motherboard may not be able to handle the voltage output of your power supply. If you have an aftermarket CPU cooler, such as a liquid-cooling system, then you might want to consider buying a better PSU with more wattage. Another thing that can cause problems is simply having too many devices plugged in at once; try unplugging everything but your CPU and video card (if you have one). If that doesn't help, then it's likely you need to disable some startup programs or invest in better hardware.

3) Loud squealing sound on startup

- The only way to fix this problem is by purchasing new fans for your case. While you're at it, you should look into putting some stronger fans in your case, because the standard ones that came with it probably don't do a very good job at cooling down your already-overworked motherboard.
- 4) Computer randomly shuts off
- You need a better power supply unit. If your computer shutdowns down randomly while using it, most standard power supplies cause this problem. The only way to fix it is by buying a better PSU, so that you never experience the issue again. If you have an aftermarket CPU cooler, such as a liquid-cooling system, then you might want to consider buying a better PSU with more wattage.
- 5) Computer does not turn on
- If you have done everything above and are still having trouble getting your computer to turn on, then you might have a dead power supply unit. I know what you're thinking—how can that be? It doesn't work when I plug it into electricity! Well just because the PSU's button light turns green doesn't mean that there is enough power being sent through its wiring to the motherboard.
- 6) Computer turns on but is unable to boot into Windows or any other software
- This problem may be caused by your computer trying to boot from an external device (e.g., flash drive). Turn off your computer and try unplugging everything that isn't essential for seeing if this helps with the issue. If this doesn't work, you might need to get in touch with our [Melbourne computer repair](#) experts.
- 7) Computer shuts off continuously while running
- This again can be caused by your power supply being bad or inadequate, so replacing it with a better one should solve the problem. If this doesn't work, continue down to number 7.
- 8) Computer runs slowly/freezes randomly/crashes frequently
- Overheating is an extremely common cause of these issues, causing either hardware failure or system slowness. You can buy an external fan for about \$10 that attaches to the outside of your computer case and blows cool air inside. If this doesn't fix your problem, you might have to replace overheated components such as your CPU and GPU.