Chapter-8

Computer Hardware used in Library: Concepts

After studying this section, students will be able:

- *To understand the need of ICT in libraries;*
- *To gain knowledge about the Desktop system and its components;*
- *To gain knowledge about the printers and their functionality;*
- *To gain knowledge about scanner and it various types;*
- *To understand various networking components;*
- *To gain knowledge about the wireless technology and its tools.*

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8.1 Introduction

With the advent of Information and Communication Technology, the scenario of library operations has changed in Indian librarianship. Now, electronic and digital documents have replaced a good count of traditional print documents. At the same time, the library housekeeping activities have also changed from traditional manually operated system to computerised/automated systems. Due to such a major change, the internal scene of library collection and operations has received a new look in the form of ICT enabled practices. In this chapter, we will discuss about various computer hardware components and peripherals for acquainting students with the ICT based environment of libraries.

8.2 Desktop Computer

A desktop computer is type of a personal computer which is commonly made in order to use it over a single location like a desk or table. A desktop system includes a computer monitor, keyboard, mouse and other internal components like power supply, motherboard, hard drive and optical drive, etc. It is also known as home computer and workstation.

8.2.1 Characteristics

Given below are the characteristics of a desktop computer:

a. It occupies considerable space due to its big size.

b. It is a combination of monitor, keyboard, mouse, power supply and some other internal devices etc. Therefore it is not a portable device.

c. It is heavy in weight.

d. It is easy to operate.

e. It is suitable for office use.

8.2.2 Computer Hardware for Desktop

Computer hardware is the tangible part of a computer. In the computer world, it refers to the physical components that make up a computer system. It includes keyboard, monitor, mouse etc. The modern computers are better in terms of processing speed and memory. Computer is made of different physical parts inside it and this is known as the hardware. Some important computer hardware components are:

8.2.2.1 Central Processing Unit(CPU)

Central Processing Unit is the main part of the computer. It represents the working power of a computer system and is also known as computer brain. All processing works of a computer system are performed by its CPU. CPU is also accountable for performing and controlling the works of the others parts of a computer system. It transfers the data onto the motherboard.

8.2.2.2 Motherboard

A motherboard is the mother of all hardware components of a computer system. All other parts of a computer system are attached to motherboard. Motherboard is a part of the computer hardware that is hidden inside its CPU.

8.2.2.3 Hard Disc

Hard Drive is the storehouse of a computer system. It is the place where all programs of a computer including its basic data are stored. When you save any file, it goes to the hard disc; also you are able to retrieve a specific file through its unique path, which is allotted to each document.

8.2.2.4 Random Access Memory (RAM)

The Random Access Memory is the volatile memory of a computer. It is used to store the information in the computer that needs to be accessed often and quickly. RAM consists of an integrated circuit (Chip) and is attached to the motherboard of the computer system. When RAM is sufficient, the computer system works faster and processes information and data quickly.

8.2.2.5 Visual Display Unit (VDU)

Visual Display Unit is popularly known as monitor. It is the most popular hardware

device for display and presents data in soft form as output. A Monitor is connected to a keyboard and together they form a video display terminal which is also a hardware. Now-a-days, basically two types of monitors are in use - Cathode Ray Tube (CRT) and Liquid Crystal Display (LCD).

Figure 8.1: Monitor

8.2.2.6 Keyboard

Keyboard is a commonly used input device. Keyboard is a part of a computer system which is used to key-in the letters and instructions to the computer system for initiating a task. Today, the most popular keyboard uses 101 keys and is known as QWERTY keyboard.

Figure 8.2: Keyboard

8.2.2.7 Mouse

A computer mouse plays a vital role in the computer system. It is a popular point-and-draw device. A mouse is made of two or more buttons and a wheel. When the mouse is moved, it moves the cursor on the screen of the monitor. The functions of a computer mouse are multifaceted, as it performs various functions like click, copy, paste, drag, drop, etc.

Figure 8.3: Mouse

8.2.3 Advantages of Desktop

1. It is more powerful in terms of hardware.
2. It has a large screen that makes it easier to read.
3. It has a large storage capacity.
4. It is cheaper than laptops.
5. It is easy to operate and upgrade.

8.2.4 Disadvantages of Desktop

1. It is not a portable device.
2. It occupies a lot of space.
3. It requires a separate monitor.

8.3 Printers

The printer is an output device which is used for producing text and graphics on paper. Printers are attached by a printer cable or a USB cable to a computer system which serves as a document source and instructor. On the other hand, modern printer can be directly attached to electronic media like a memory card, scanner, digital camera, etc.

8.3.1 Types of Printers

Printer can be categorised into two types on the basis of its work:

1. Impact Printer
2. Non- Impact Printer

8.3.1.1 Impact Printer

The impact printer works by massive head or needle against an ink ribbon to make a mark on the paper. In other words, this printer works when the ink ribbon comes in contact with the paper.

Example: Dot-matrix printer, Chain printer, Drum printer, etc.

8.3.1.1.1 Dot-Matrix Printer

The dot-matrix printer prints one character at a time. It follows two directional method of printing, thus, the print head runs from left to right and again right to left. Dot-matrix printer is an impact printer as it works by moving a pin head over the inked ribbon to give ink impressions on the paper through the impact of the head. It can produce various sets (copies) of printouts by using carbon paper. Dot-matrix printer is a noisy printer as, when the head and ink-ribbon strike together on the paper, noise is produced. Normally, the printing speed of dot-matrix printers is less. Mostly these types of printers are used by individuals and institutions for printing, where printing speed and quality of printouts are not important.

8.3.1.1.2 Drum Printer

The drum printer is a type of line printer, it prints the entire line at a time. The drum printers have a set of hammers in front of the drum in such a manner that an inked ribbon and paper can be accommodated between hammers and drum. The total number of hammers is equal to the bands on the drum. The drum of the drum printer is made of metal. This drum is expensive and cannot be changed. The drum printer has less flexibility in the size of characters and their description. Although, printing

speed of the drum printer is faster than a dot-matrix printer, but it is not suitable for commercial purposes or fast printing assignments.

8.3.1.2 Non-Impact Printer

The non-impact printer does not work by striking a head against the ribbon. In other words, it produces the print (text and picture) without coming in actual contact with the paper.

Example: Inkjet printer, Laser printer, etc.

8.3.1.2.1 Inkjet Printer

The inkjet printer is also a character printer. The inkjet printer's print head has upto 64 nozzles. It can be warmed in a moment by an integrated circuit resistor. When the resistor warms up, the ink flows and is ejected via nozzles making an impression on the paper in front of the print head.

An Inkjet printer produces better quality prints in comparison to impact printers. Its print resolution is also better.

Figure 8.4: Printer

8.3.1.2.2 Laser Printers

Laser printers are non-impact printers. They do not make any noise. A laser printer works through the patterns generated by a laser beam. The printing quality of these printers is very high and at the same time the printing speed is fast. But this printer is more expensive than other types of printers.

A laser printer is a page printer. It prints one page at a time. It works through the following parts:

1. A laser beam source
2. A multi-sided mirror
3. A photoconductive drum
4. Toner

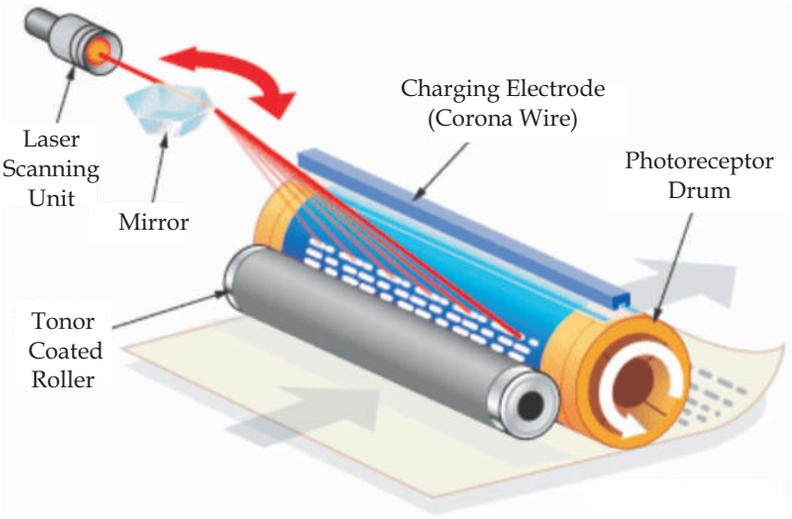

Figure 8.5: Laser Printer

8.4 Scanners

Scanners are computer support devices/peripherals, which one used to capture information from print sources and to convert that captured information in the computer readable digital form. With the help of scanners, one can save time in feed in / input data in the computer system.

8.4.1 Types of Scanners

Presently, there are various types of scanners. One can use any specific type of scanner according to one's specific requirement, based on the type of print source. Some of the common types of printers are as follows:

8.4.1.1 Flatbed Scanners

These are suitable for all types of photographs, transparencies, negatives and pages up to A3 size and anything that can be laid absolutely flat. They are not suitable for glass plates, mounted slides and documents larger than A3. As these scanners use very bright light, anything that is in danger of fading is not suitable for these scanners.

Figure 8.6: Flatbed Scanners

8.4.1.2 Drum Scanner

These are used by reprographic houses. While they produce very high-quality results, they are expensive and the originals need to be fastened around a drum, which means that the print document needs to be very flexible and unmounted.

Figure 8.7: Drum Scanner

8.4.1.3 Hand Scanners

A Hand Scanner is a manual device that is dragged on the face of the image to be scanned. It requires a steady hand to avoid uneven scanning rate else it would produce distorted images.

Figure 8.8: Hand Scanner

8.4.1.4 mm Scanners

These would seem to be ideal for collections made up of slides only. However, many of them are aimed at the domestic market and will not be robust enough for any reasonable sized collection. They often struggle to produce upto 18 Megabyte files of a good dpi.

Figure 8.9: mm scanners

8.4.1.5 Digital Cameras

Digital cameras come in a variety of standards. To be suitable for digitization work, these must be of a professional standard and should have more than 18 Megabytes with interchangeable lenses and accessories.

Figure 8.10: Digital camera

8.5 Modem (Modulator and Demodulator)

Modem is an important device of a data communication system. Modem is used for communication among various computers through telephone line. A modem converts digital signals received from a computer into analog signals for transmitting them over a telephone line and on other end, receives analog signals and converts them into digital signals for a computer system. Thus, modem is an important device of the communication process. A modem is used to carry out the modulation and demodulation process. The word 'modem' is made of two words - Modulator and Demodulator. The word 'Modulator' is derived from the word 'Modulate' which means 'convert'. So, a modulator is a device which is used to convert the digital information into analog information for a telephone line. While the other word 'demodulator' changes the analog signals to digital signals for a computer system. Thus, a modem allows two computers to communicate over a telephone line.

8.5.1 Types of Modem

On the basis of structure and design, there are mainly two types of modem:

1. Internal Modem
2. External Modem

8.5.1.1 Internal Modem

The internal modem is in the form of a detachable card and is placed inside the system unit. It is an optional add-on circuit board that may be attached in one of the computer expansion slots. It is inbuilt with the computer system. It takes power from expansion slot of the computer.

Figure 8.11: Internal Modem

Figure 8.12: External Modem

8.5.1.2 External Modem

The external modem is attached outside the system unit. It is connected to the mother board through a port. It has its own power supply and its front panel displays the connection status. An external modem is connected with a computer through a port. It is more expensive than internal modem.

8.5.2 Usage of Modem

In the early days, modems were used to communicate between data terminals and the host computer. Later, the use of modems was extended to communicate among end computers. Now-a-days, a modem is used for performing various activities including transferring data to remote systems where it is not possible to lay down network cable but telephone lines are easily available. Thus, it provides a cheap networking solution.

8.6 Wi-Fi

Wi-Fi allows connection to the network through a wireless router or access points. Wi-Fi stands for Wireless Fidelity. Here, the wireless network utilizes radio waves in the form of communication channel between computers. Wireless computing systems communicate by modulating radio waves or pulsing infrared light. Wireless communication is linked to the wired network infrastructure by stationary

transceiver. The area covered by an individual transceiver's signal is known as a cell. Cell sizes vary widely. For instance, an infrared transceiver can cover a small meeting room, a cellular phone transceiver has a range of a few miles and a satellite beam can cover an area more than 400 miles in diameter.

8.6.1 Wireless Technologies

8.6.1.1 2G and 3G Technology

The second generation of wireless networking technology is known as 2G technology; that is digital, circuit-based and narrowband but comfortable for voice and limited data communications. The third generation wireless networking technology is known as 3G technology that is suitable for voice and advanced data applications, including online multimedia and mobile e-commerce.

8.6.1.2 Wireless LANs

Wireless Local Area Networks (WLANs) are like traditional LANs having a wireless interface to enable wireless communication between the devices that are a part of the LAN. The component of a wireless LAN is the wireless interface card that has an antenna. Wireless LAN has limited coverage and is made to be used only in Local Area such as a room or a building.

8.6.1.3 WIMAX

WIMAX stands for Worldwide Interoperability for Microwave Access. WIMAX provides the wireless data communication over long distances in different ways, including point to point link and full mobile cellular type access. WIMAX operates in the frequency band between 3.3 to 3.4 GHz.

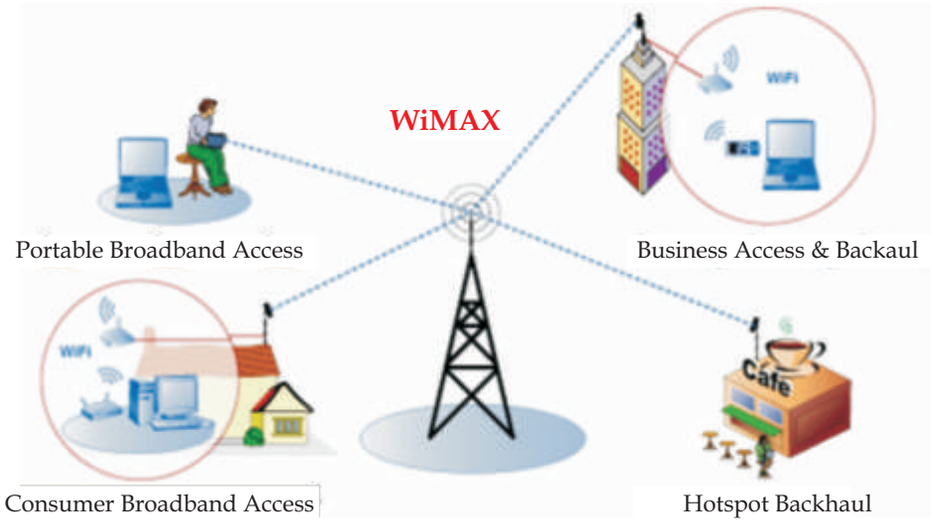

Figure 8.13: Wimax

8.6.1.4 Radio Router Technology

Radio router technology uses a radio transmission framework for packet based, broadband, IP wireless communications. It is an emerging wireless technology designed to make links in an IP network.

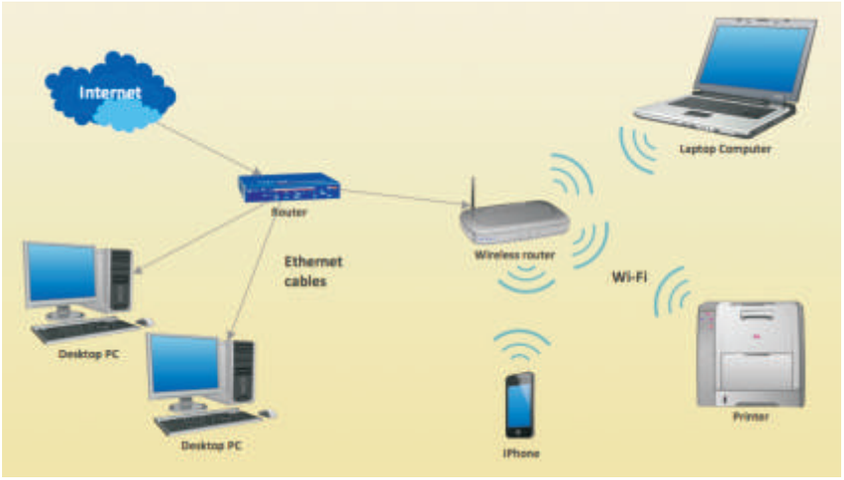

Figure 8.14: Radio Router Technology

8.7 Bar Code Technology

Barcode technology plays an important role in automating various activities of a library. The application of bar code technology increases the speed and accuracy in library operations. Barcode technology provides a simple and inexpensive method of encoding text information that is easily read by electronic devices. A bar code consists of a series of parallel, adjacent bars and spaces. Predefined bar and space patterns are used to encode small strings of character data into a printed symbol. A bar code reader/scanner decodes a bar code by scanning a light source across the bar code and measuring the intensity of light reflected back by the white spaces. The pattern of reflected light is detected with a photodiode which produces an electronic signal that exactly matches the printed bar code pattern. This signal is then decoded back to the original data by electronic circuits.

8.7.1 Bar Code Reader

The bar code reader is a device which is used for reading bar coded data. It may be a hand-held scanner or embedded in stationary scanner. It scans a bar code image and converts it into an alphanumeric value that is then fed to the computer. It uses laser beam scanning technology.

Figure 8.15: Bar Code Reader

8.7.2 Bar Code Writer

The bar code writer is a type of computer printer which prints bar codes on the slips or stickers. These bar codes are generated by bar-coding software against specific record of the stored database.

Figure 8.16: Bar Code Writer

8.7.3 Basic Requirements for Barcode Application

For implementing bar coding in library applications, following hardware and software are required:

a. Personal computers
b. Barcode Scanner
c. Decoder
d. Printer
e. Printing Software
f. Database of library holdings
g. Library Automation Software
h. Membership database

8.8 RFID - Radio Frequency Identification Technology

Application of Radio Frequency Identification Technology in libraries make library operations easy for visitors and librarians both. RFID is the latest technology which is used in library for implementing theft detection system. RFID based systems facilitate easy and fast charging and discharging system. RFID system is developed with the support of two technologies-radio frequency based technology and microchip technology.

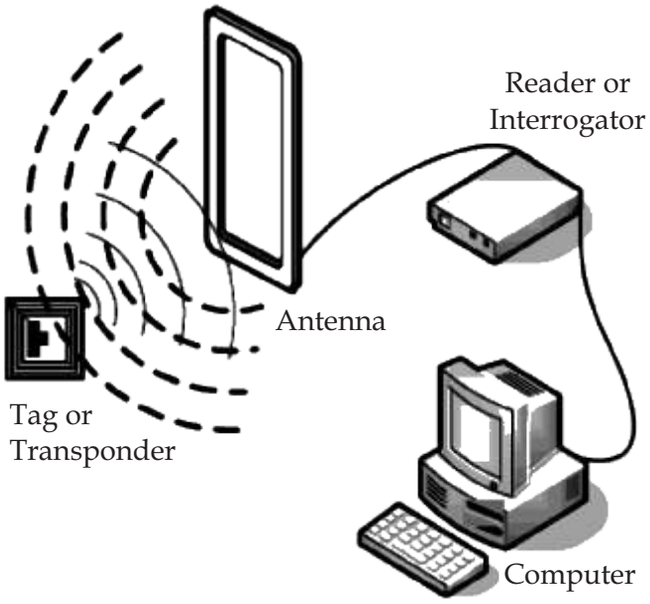

Figure 8.17: RFID system components

Microchips in the form of tags are used for storing information and are affixed on library materials, while this information is read with the help of radio frequency technology. The devices used for circulation and inventory purpose are usually called "readers" while the device used at the library gate are usually called "sensors".

8.8.1 Components of an RFID System

A comprehensive RFID system has four components

1. RFID tags that are electronically programmed with unique information
2. Readers or sensors to query the tag
3. Antenna
4. Server on which the software that interfaces with the integrated library software along with the appropriate database

8.8.2 Advantages of RFID in Libraries

1. It provides the self charging and discharging support.
2. It facilitates a high level of reliability.
3. The life of RFID Tag is quite long.
4. It has changed the circulation system by facilitating fast circulation activity.
5. It simplifies the process of stock verification.
6. It partly supports theft detection.
7. It facilitates a high level of security.
8. It can easily identify misplaced documents inside the stack.
9. RFID tags are very simple to install/inject inside the books.

8.9 Switches

A network switch is a computer networking device which is used to connect many computer devices to one another over a network. Switches in network are also known as switching hub, but a network switch is more advanced than a network hub, as a switch sends only those messages to the device which are demanded. A network switch is a multi-ported network bridge that processes and forwards data at the data link layer of the OSI model. Some switches have additional

Figure 8.18: Switches

features, including the ability to direct the packets. These switches are commonly known as multilayer switches. Switches exist for various types of networks including Fiberoptic, Asynchronous Transfer Mode, Ethernet, etc.

8.9.1 Types of Switches

There are four main types of network switches which are available for connecting devices. These are as follows:

1. Managed Switches
2. Unmanaged Switches
3. Smart Switches
4. Enterprise-managed Switches

8.9.1.1 Managed Switches

A managed switch is a device whose software gives permission to the user for modifying and updating the settings of the switch. This type of the device needs a knowledgeable user to change the setting of the switch according to his/her needs.

8.9.1.2 Unmanaged Switches

An unmanaged switch is another type of network switch. It is the cheapest option to connect devices. Unmanaged switch performs the main functions of managing the data flow between a connected device and multiple computers. This type of switch is basically used in small offices and business organisations.

8.9.1.3 Smart Switches

Smart switches carry both types of network switch (Managed and Unmanaged) character. It provides interface of web based and popular default settings to the user.

8.9.1.4 Enterprise managed Switches

An enterprise-managed network switch provides a wide range of adjustable settings to allow customised use within the campus. These are usually managed by network specialists and are constantly monitored, due to the size and complexity of the network.

8.10 Router

A router is a device that sends the data along networks. Routers are located at gateways, places where two or more networks connect, and are the critical devices for keeping the data flowing between networks and keeping the networks connected to

the Internet. This networking device filters the data and manages the data flow between computer networks. A router is connected to two or more data lines from different networks. Data breaks into two parts, into header and trailer, and it flows in packet among networks. When packets come in one of the lines, the router reads the address information in the packet to determine its ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey. Routers work like "traffic police" on the Internet.

Figure 8.19: Router

The most popular type of routers are home and small office routers that simply pass data, such as web pages, email, IM, and videos between the home computers and the Internet. An example of a router would be the owner's cable or DSL modem, which connects to the Internet through an ISP. More sophisticated routers, such as enterprise routers, connect large business or ISP networks upto the powerful core routers that forward data at high speed along the optical fiber lines of the Internet backbone.

8.10.1 Types

There are four types of routers, which are as follows:

8.10.1.1 Brouter

Brouter is the short form of Bridge Router. It is a networking device that serves as a bridge and a router in parallel manner.

8.10.1.2 Core Router

A core router is a router in a computer network that routes data within a network, but not between networks.

8.10.1.3 Edge Router

An edge Router is a router in a computer network that routes data between one or more networks.

8.10.1.4 Virtual Router

A Virtual router is a backup router used in a Virtual Router Redundancy Protocol (VRRP) setup. VRRP is defined as a protocol used with routers that helps in

preventing network downtime. In the event of a router failing, the backup or virtual router becomes the master router.

8.11 Summary

In this chapter we have discussed all possible ICT components which are essential for computerised and automated library and information centre. We have discussed about their utility and functions for improving the functionality of modern libraries.

8.12 Glossary

Bar code: Bar code consists of a series of parallel, adjacent bars and spaces. Predefined bar and space patterns are used to encode small strings of character data into a printed symbol.

IP: Internet Protocol

RFID: It stands for Radio Frequency Identification technology. It is the latest technology which is used in library for implementing theft detection system.

Router: Router is a device that sends the data along networks. Routers are located at gateways, the places where two or more networks connect, and are the critical devices that keep data flowing between networks and keep the networks connected to the Internet.

Switch: A network switch is a computer networking device which is used to connect many computer devices to one another over a network.

WIMAX: WIMAX stands for Worldwide Interoperability for Microwave Access. WIMAX provides the wireless data communication over long distances in different ways, including point to point link and full mobile cellular type access.

8.13 Exercise

Short answer type questions

1. What is the role of the CPU in a computer system?
2. Discuss the advantages and disadvantages of a desktop system.
3. What is the difference between an Impact printer and a Non-impact printer?
4. Which type of printer produces fast and quality output? Explain why?
5. What is the use of a printer in a library?
6. What do you mean by a scanner?

7. Discuss various types of scanners.
8. What is the difference between a flatbed scanner and a digital camera in terms of utility?
9. What do you mean by a Modem?
10. How does a Modem work?
11. Discuss the role of a Modem in information transfer over a network.
12. What do you understand by Wi-Fi?
13. Discuss various wireless technologies.
14. What is the difference between cabled and Wi-Fi connection of a network?
15. What do you mean by a Bar code?
16. How does Bar code technology support library automation process?
17. Discuss various requirements of bar code applications in libraries.
18. What do you understand by RFID?
19. Discuss various components of RFID system.
20. Point out various advantages of RFID application in libraries.
21. What is the role of a switch in a computer network?
22. Discuss various types of switches.
23. Differentiate Managed switch and Unmanaged switch.
24. What are the basic functions of a Router?
25. Explain various types of Routers.

Long answer type questions

1. Discuss various components of a desktop system.
2. Explain the utility and requirement of scanners in a modern library.
3. Point out various benefits of Wi-Fi network over cable network.
4. What is the role of bar coding and RFID in automating library operations? Explain.