Quadrant-I (e-Text)

Details of Module and its structure

Module Detail	
Subject Name	**Education**
Course Name	ICT in Education
Course Code	**EDU504**
Module Name/Title	Managing the ICT infrastructure: software installation, troubleshooting of hardware, seeking and providing help, storage and backup, updating and upgrading software.
Module Code	IIE018
Pre-requisites	Meaning of ICT, Basic understanding of computers, Importance of ICT in teaching learning.
Objectives	After going through this lesson, the learners will be able to: 1. Discuss the importance of ICT infrastructure in schools 2. Describe the ICT Infrastructure as per ICT@school scheme in India 3. Act upon the roles and responsibilities of stakeholder in managing the computer lab 4. Classify the types of softwares 5. Discover and solve the troubleshooting of hardware 6. identify the types of storage devices for computers 7. design the rules for the computer lab
Keywords	ICT Infrastructure, Software's, Storage Devices, ICT@schoolscheme

8. Development Team

Role	Name	Affiliation
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Introduction

This module will provide you the understanding of managing ICT infrastructure in school system. ICT Infrastructure is used to describe ICT network and its related component parts which are used to manage various tasks in school.

Information and Communication Technology (ICT) is used to improve the teaching learning process in the schools. It is used by all the stakeholders of the school like Administrators, Teachers and students. In the era of digital technology, no person is lagging behind to use computers in his/her daily life. All the schools are now bound to use smart technology in their teaching and administrative work. Be it internet, computers, multimedia, tablets, smart boards, or any other technology like Television, mobiles etc. This enhances the students learning and allows the teachers and students to interact in better way. It provides more opportunities for learning on individual basis and thus catering the needs of individual learners. Assignments, tutorials, videos, audio, multimedia and various other e-resources can be accessed by the teachers and students through the use of digital technology. With the use of ICT the stakeholders can store, share, transmit, and exchange the information in better way.

The usage of ICT in school is dependent on the reliable infrastructure. If the infrastructure is well established, then the usage will be more fruitful. The ICT infrastructure enables to share the ICT capabilities which provide services for other systems of the organization (Broadbenta et. al., 1999). For Broadbenta et. al. these capabilities require the complex combination of the technical infrastructure (cabling infrastructure, hardware platform, base software platform), ICT shared services (as communications services), ICT applications (as WEB services), the human operators and the managerial expertise to guarantee reliable services. Infrastructure at the schools must match the specific requirements of the school. All the resources should be managed, designed and developed over the time.

ICT setup and maintenance involves funding and costs which should be managed through annual budget on regular basis. It includes the purchase of hardware and software's and maintenance of the systems. ICT procurement and management are a major investment for every school and involve ongoing costs. We cannot neglect the costs of technical support also. For this a necessary planning has to be done on annual basis in the school budget.

After setting up of the ICT infrastructure, managing the ICT infrastructure is a key element in any organization. All the components of the infrastructure have to interact with various persons in the school system. So managing the infrastructure in presence of all is a tedious task. Each person in the system has to take the responsibility of managing the infrastructure for longer sustenance of the setup. With this vision we have to consider the ICT infrastructure as a complex system. The users of ICT should innovate the applications for better usage then the infrastructure will be said to be well maintained.

ICT Infrastructure in Indian Schools

It is the responsibility of every school to set the ICT infrastructure for their students and teachers. In our country school system is governed by both Private and Government agencies. Private players set their computer infrastructure by their own but for the government schools of the country, Government of India (GoI) had launched a scheme, 'ICT@Schools Scheme' for setting up an ICT lab in Government and government aided secondary and higher secondary schools in India. It was launched in December, 2004 and revised in 2010 to provide opportunities to secondary stage students to mainly build their capacity on ICT skills and make them learn through computer aided learning process.

ICT@school scheme

The Scheme is a major catalyst to bridge the digital divide amongst students of various socio economic and other geographical barriers. The Scheme provides support to States/UTs to establish computer labs on sustainable basis. As per this 150 smart schools would be set up by State Government and UTs at the district level using a grant of Rs. 25 lakhs for a schools and a recurring grant of Rs. 2.5 lakh per year. This would enable provision of at least 40 computers in each such school. (As per *Guide for Implementation of the ICT@Schools Scheme & Model Bid Document, 2010)*

ICT infrastructure has to be deployed through Public Private Partnership (PPPs) and the central Government initially recommended that States with limited capacity adopt the BOO/BOOT (Build Own Operate and Transfer) model. Under this model, a BOOT operator is responsible for procuring, deploying and maintaining the hardware. After a period of five years, the BOOT operator transfers this infrastructure to the States. Besides this, the BOOT operator is also responsible for supplying the content, establishing smart schools as well as hiring and training teachers.

The following is taken care under this scheme-

1. **Infrastructure Hardware and software**: Each school would be provided with 10 PCs or 10 nodes connected through a server. Accessories like printers, projection system, etc. will also be provided. Keyboards would be customized for use in the regional languages.
2. **Connectivity:** The first priority would be to have a broadband internet connection of at least 2 MBPS bandwidth in each school. Wherever that is not possible, connection of lower bandwidth would be provided with plan to upgrade in future.
3. **Power Supply:** Wherever the power supply is unreliable, it is proposed to provide assistance for purchase of a generator, as a backup only and also

its recurring cost, subject to a maximum of Rs.1000 per month, in addition to Rs 1000 per month for the electricity charges. In areas where there is no power supply, solar generated power should be made use of.

4. **Computer Room/Lab:** The computers would be installed in one of the safe rooms in the school. If such rooms are not available, the need can be met from the scheme Rashtriya Madhyamik Shiksha Abhiyan (RMSA) in case of Government schools.

It is also mentioned that, the National Council for Teachers Education (NCTE) shall be associated with the scheme in the context of training of teachers in computer-aided learning. The Rehabilitation Council of India (RCI) would play an important role in projects involving introduction of use of technology for the education of Children with Special Needs (CWSN). (For details of ict@schoolscheme: http://ictschools.ncert.gov.in/index.php/ictschools-scheme/)

ICT Infrastructure as per CBSE

Central Board of Secondary Education (CBSE) has also given some guidelines to set Computer Laboratory in schools. There is no minimum size prescribed but a school should have separate provision. The lab should have minimum of 10 computers or computer student ratio of 1:20 and proper software. Wherever such facility is available, every school should have the facility of Broad Band Connectivity with the feature of Internet always on from any service providers. Along with this each affiliated school has to develop their own website containing comprehensive information such as affiliation status, details of infrastructure, details of teachers, number of students, address-postal and e-mail, telephone nos. etc. (As per CBSE Affiliation Bye-Laws)

ICT Infrastructure for other processes

Besides teaching and learning ICT is used for other aspects in the schools. For automation of school processes like in school administration, library

automation, maintenance of records, student tracking attendance, etc. School Management Information Systems (School MIS) (for digital repositories of tools, content and resources); professional development and continuing education platforms; and guidance, counseling and other student support services. These are the other major activities for which ICT infrastructure has to be maintained.

Every ICT laboratory should have the enabling infrastructure having regular and regulated supply of electricity, appropriate electrical fixtures, and adequate power backup. Physical facilities like an adequately large room, appropriate lighting and ventilation, durable and economic furniture. Even the sitting arrangement should be focused so that maximum student to student interaction is possible. Adequate safety precautions like fire extinguisher and rules has to be established. All the equipment and resources should be secured from theft and damage.

As per ICT@schools scheme implementation in states: an evaluation (2014) was done and through informal interactions with principals and teachers it was found by the researchers' that the computers were not in use because of lack of electricity, inadequate space, leaking roofs and broken windows in the places where they could have been kept. Some others blamed inadequate security to prevent burglary of the computers, lack of staff competencies on computer use and lack of technical support for their installation and use.

This increases the role and liability of the administrators and teachers to maintain the infrastructure as well.

ROLE OF MAINTAINING ICT INFRASTRUCTURE BY VARIOUS STAKEHOLDERS OF SCHOOL

The importance of managing the ICT infrastructure in schools is to provide a stable operating environment for everyone who is using the technology. Monitoring and maintenance of ICT Infrastructure is a must on regular basis. This will be a responsibility of all the stakeholders. It is the duty of each school

to ensure that all staff is aware of their responsibilities. To ensure continued access to reliable and robust ICT services, schools must take responsibility for managing ICT assets. Here are some role and responsibilities of different stakeholders to manage the computers of a school:

Role of Administrator

Administrator has a key role to set up a computer lab and also maintain it. Starting from budget allocation to procuring equipment's till the safe disposal of the computers. It also includes the interventions from training of teachers to the appointment of technical support for ICT in school. This will bring the quantity and quality, having the considerable impact on ICT implementation by the teachers'. School administrator need to make the balance between usability and security. He/She should create a networked infrastructure in the school for easy communication. Though the funding under ICT@school scheme is done in almost half government schools of nation but the role doesn't end here. The administrators have to maintain the full-fledged infrastructure in each school. The principals should promote and encourage the use of ICT by all the subject teachers by organising the workshops. The principals should regular intervene to ensure that the hardware and software was available to all teachers and in working order.

As schools commit more funds to the purchase of technology, they must also look at the support needed by the end users of these purchases. A regular computer teacher and also a technical support must be hired for the maintenance of ICT lab. Usually the technical support was called as per requirement when there is a major infrastructure malfunction or new equipment is being installed. The majority of support personnel time is focused on acquiring, installing, and maintaining hardware and the technology infrastructure. Administrators should see that technicians should visit the classroom to provide support besides manage and store hardware in the lab. Also the teachers must acquire the knowledge to solve some basic hardware and

software related issues themselves Training programmes must be organised for teachers to learn the integration of ICT in particular to their teaching subjects. This will also help to maintain the ICT infrastructure, as more usage and smooth functioning.

Role of Teacher

ICT use in school curriculum depends highly on the teachers who will use ICT to teach the students. This requires that teachers have the capacity to incorporate ICT into teaching (Osadalor, 2008). If a teacher will not be able to use the equipment in the way they want then they will not bother using them. Teacher can use the lab for administration purpose, for their own professional development besides teaching. So to maintain the ICT infrastructure for appropriate usage it should be used by the teachers. Teacher should have good training for management of infrastructure, so that they will not have to struggle with the system and correctly implement the functions to solve the issues. They should not be dependent on technical support all the time. Besides this he/she had to plan some rules for students, so that each student will get opportunity to use the system and maintain the lab. They should be exposed to the lab and learn good habits for using technology in school. For this teacher should monitor their behaviors and activities to ensure they follow the rules and regulations of the computer lab.

Role of Technical Staff

The major challenge is for the technical recruit in the school to manage the computer lab. He/ She should be troubleshooting with software and hardware for working with other peripheral equipment, such as printers and scanners. The nature of work for him/her is to maintain operation of the computers and the network, supervision of lab equipment and facilities, keeping records of equipment and lab supplies, and maintaining the security of the lab. They should assist students in the lab by demonstrating the proper use of the equipment and

how to use the hardware and software to finish assignments. If any system or technical problems arise, the computer lab technician may be called to provide assistance from outside. They also provide backup of software and perform equipment repairs. Technical support should ask the administrators for regular updates and upgardes of softwares and also recommend some new hardware/software. Prepare requisitions for computer hardware and software purchases.

SOFTWARE INSTALLATION

Software could be considered as the language of a computer. It is the combination of programmes/commands used by products containing processors. That is, software is a set of programmes/commands designed to perform a well-defined task.

Types of software's

On the basis of purpose there are two main types of software: systems software and application software.

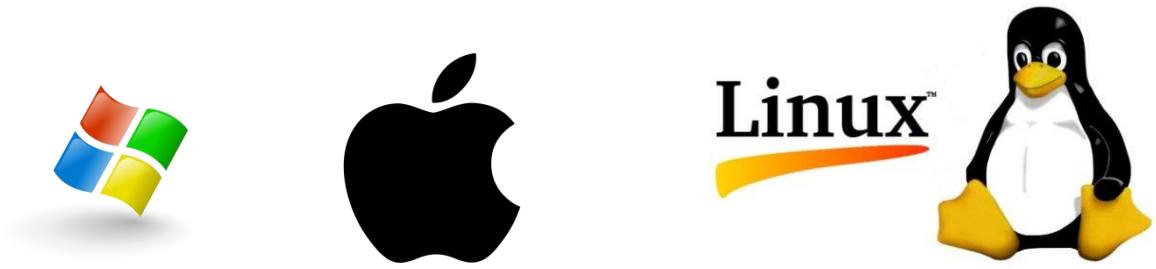
A. **Systems software** includes the programs that are dedicated to managing the computer itself, such as the operating system, file management utilities, and disk operating system (or DOS). System software includes:

a) **An operating system (OS)** is the most important software that runs on a computer. It is the system software which manages the computer's memory, and processes all of its software and hardware. Operating systems is usually pre-loaded on any computer when it is bought but we can upgrade or even change operating systems. The three most common operating systems for personal computers are Microsoft Windows, Apple Mac OS X, and Linux. Among these the most dominant is Microsoft Windows and then Mac OS and Linux respectively.

- Microsoft Windows - Microsoft created the Windows operating system in the mid-1980s. Over the years, there have been many different versions of Windows, but the most popular ones are Windows 7 (released in 2009), Windows Vista (2007), and Windows XP (2001).
- Apple Mac OS X- Mac OS is a line of operating systems created by Apple Inc. It comes preloaded on all new Macintosh computers, or Macs. All of the recent versions are known as Mac OS X (pronounced Mac O-S Ten), and their specific version names are Lion (released in 2011), Snow Leopard (2009) and Leopard (2007).

Linux- Linux is a family of Open Source Operating Systems (OSS), which means that they can be modified and distributed by anyone around the world. This is very different from proprietary software like Windows, which can only be modified by the company that owns it (Microsoft). The advantages of Linux are that it is free and there are many different distributions (or versions). Each distribution has a different look and feel, and the most popular ones include Ubuntu, Mint, and Fedora.

Figure 1: Operating systems



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(**b) Device Drivers** - which operate or control a particular type of device that is attached to a computer. Each peripheral device will work when a particular

driver is installed in the computer. Driver software is a type of system software which brings computer devices and peripherals to life. Examples of devices which require drivers: Mouse, Keyboard, Soundcard, Printer, etc.

(c) Firmware- Firmware is the operational software embedded within a flash, ROM, or EPROM memory chip for the OS to identify it. It directly manages and controls all activities of any single hardware.

(d) Programming Language Translators - These are intermediate programs relied on by software programmers to translate high-level language source code to machine language code. The former is a collection of programming languages that are easy for humans to comprehend and code (i.e., Java, C++, Python, PHP, BASIC). The latter is a complex code only understood by the processor.

(e) Utilities - which are computer programs designed to assist users in the maintenance and care of their computers. Utilities are types of system software which sits between system and application software. These are programs intended for diagnostic and maintenance tasks for the computer. Examples and features of utility software include: Antivirus and security software, File Compression, Firewall etc.

B. Application Software - Application software performs some specific task on a system. They deal mainly with solving out some specific computing types of problems. Some of the common application software are-

- Word Processors – These software programs are used for creation of documents. It also assists in storing and printing that document. For eg. MS Word.
- Database software – This software is capable of creating databases. For eg. MS Excel.

- Multimedia software – This software has been devised to work with different types of media usually used in multimedia presentation. For eg. MS Power Point.
- Graphic software – These software programs assist in working with graphics, as it enables the user to edit or manipulate visual images. It includes image editors and illustration software. For eg. Adobe Photoshop and Corel Photo paint.
- Web Browser – This is a software program which is used for locating and retrieving files or resources on the World Wide Web (WWW). For eg. Internet explorer and Google Chrome.

Note: As per ICT scheme the provision for software shall include Learning Management Systems (LMS) & curriculum based courseware apart from operating systems and other application software. In the present scenario we all should start using Free and Open Source Softwares (FOSS) which are available mostly for all teaching subjects. These can be downloaded freely from internet and used by teachers and students.

Assistive Technology

Besides the entire ICT infrastructure we should also cater the needs of children with disabilities. Their needs in technology are different. So to make them use technology we should have a provision for assistive technologies. IDEA defines assistive technology as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability. The assistive technology can include Screen readers, Desktop video magnifier, Large-print and tactile keyboards, some special softwares like Job Access with Speech (JAWS) etc. Where pupils need specialist technologies in school, these should be considered as part of the ICT infrastructure of the school.

Troubleshooting of Hardware

Hardware troubleshooting is the process of reviewing, diagnosing and identifying operational or technical problems within a hardware device or equipment. It aims to resolve physical and/or logical problems and issues within a computing hardware. Hardware troubleshooting is done by hardware or technical support. Troubleshooting starts with the identifying the problem and then to reach solution of the particular problem. It is generally done on hardware equipment installed within a computer, server, laptop or related device.

Some processes within hardware troubleshooting include:

- Removing, repairing and replacing faulty RAM, hard disk or video/graphic card.
- Cleaning dusts from RAM and Video carts slot/ports and from cooling fan.
- Tightening cable and jumpers on motherboard and/or components.
- Software related hardware problems such as device driver update or installation.

General tips to keep in mind

There can be many causes of problems in the computer. Many time trial and error methods win but you should try different methods to fix the issue. Here are some tips-

- Write down all the steps so that you can avoid having mistaken. This will help to ask the query to expert/teacher easily.
- You can post your queries to the particular proprietary of the software or on any quora forums.
- Write down the error message or take a screenshots so that you can ask for help.
- If some hardware is not working you can tighten the cables also.
- Sometimes just restarting the computer works well.

Seeking and Providing Help in schools

Whenever the problem arises in ICT infrastructure of a school, a responsible person having skills to rectify them came into focus. Besides taken care of all the systems and playing individual roles properly technology can be vulnerable. For this ICT Scheme has a provision to appoint a dedicated computer teacher for every secondary or higher secondary school in the same manner as a separate teacher is required for every other each subject at the secondary and higher secondary stage. Wherever higher secondary and secondary schools are combined, a PGT in IT/ computer science may be appointed to teach the IT related elective subject in the higher secondary stage and also to teach computer literacy in classes IX and X as well. In case of high schools without higher secondary stage, an IT teacher may be appointed on contract basis or through provisioning under 'BOOT model'.

This will also help in managing the ICT infrastructure and also to carry out risk assessments on a daily basis. He/She can provide the solutions of the problems identified. Some FAQs can be developed for students to train them for simple issues. Initial training and familiarization of the equipment's and software's should be done for the students and teachers of the school. From this some preventive maintenance procedures could be possible. Basic replacement of hardware's should be in the stock for emergency cases. Some repair tools and diagnostic softwares must be present in school.

Maintenance of the computers can also be provided either by persons who are part of the school system or through an outsourced contract. Some maintenance includes-

- periodic replacement of parts and renewal of consumable supplies;
- repair or replacement of faulty components;
- periodic inspection and cleaning of equipment;
- updating or upgrading hardware and software, including installing new versions of operating system.

STORAGE AND BACKUP

A backup and storage devices are used to make copies of the data saved in our computer. Backup storage enables the maintenance, management, retrieval and restoration of backup data for any individual, application, computer, server or any computing device. The backup storage itself can be a hard disk drive, compact disk drive etc. Here are the types of storage:

1. External Hard Drive

These are hard drives similar to the type that is installed within a desktop computer or laptop computer. They can be plugged into the computer or removed and kept separate from the main computer. It is very good option for local backups of large amounts of data.

Source:
https://commons.wikimedia.org/wiki/File:Portable_Hard_Disk_1TB_Western_Digital.jpg

2. USB Thumb Drive

They have no moving parts making them quite robust. They are extremely portable and can fit on a keychain. They are ideal for backing up a small amount of data.

Source: https://commons.wikimedia.org/wiki/File:USB_flash_drive_icon.svg

3. Optical Drive (CD/ DVD)

CD's and DVD's are ideal for storing a list of songs, movies, media or software for distribution or giving to a friend. They are usually used due to low cost. They do not make good storage options for backups due to their shorter lifespan, small storage space and slower read and write speeds.

Source: https://pixabay.com/vectors/dvd-cd-rom-compact-disc-cd-digital-152917

4. Cloud Storage

Cloud storage is storage space on commercial data center accessible from any computer with Internet access. It is usually provided by a service provider. A limited storage space may be provided free with more space available for a subscription fee. Examples of service providers are Google Drive (associated with gmail id and having total of 15 GB capacity), Sky Drive etc.

Source: https://commons.wikimedia.org/wiki/File:Google_Drive_logo.png

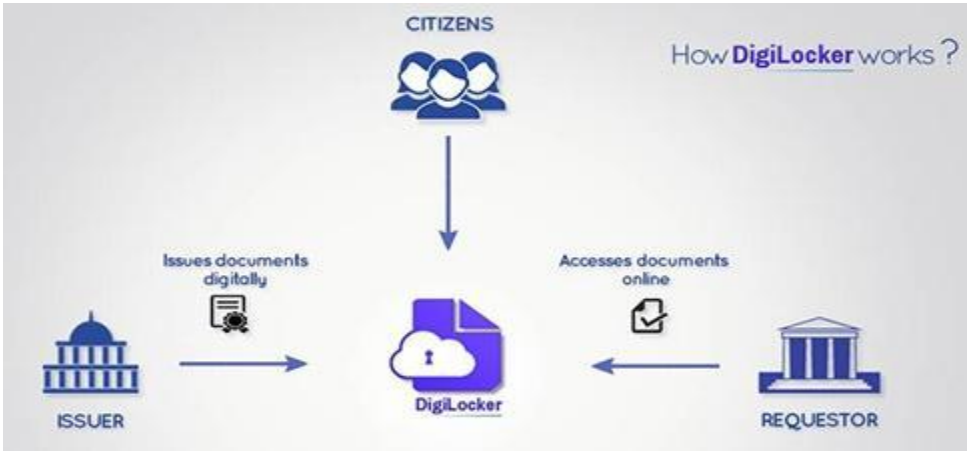
5. Digital Lockers

DigiLocker is a platform for issuance and verification of documents & certificates in a digital way, thus eliminating the use of physical documents. Indian citizens who sign up for a DigiLocker account get a dedicated cloud storage space that is linked to their Aadhaar (UIDAI) number. Organizations that are registered with Digital Locker can push electronic copies of documents and certificates (e.g.

driving license, Voter ID, School certificates) directly into citizens lockers. Citizens can also upload scanned copies of their legacy documents in their accounts. These legacy documents can be electronically signed using the eSign facility.

The platform has the following benefits:

1. Citizens can access their digital documents anytime, anywhere and share it online. This is convenient and time saving.
2. It reduces the administrative overhead of Government departments by minimizing the use of paper.
3. Digital Locker makes it easier to validate the authenticity of documents as they are issued directly by the registered issuers.
4. Self-uploaded documents can be digitally signed using the eSign facility (which is similar to the process of self-attestation).



For More details on DigiLocker (https://digilocker.gov.in/resource-center.php)

UPDATING AND UPGRADING SOFTWARE

ICT infrastructure has to be upgraded and updated on regular basis for proper functioning of the system. Software updates is done to address security issues when they occur, to address minor bugs discovered in the software, to improve the operation of hardware or peripherals, and to add support for new models of equipment. It is good to install security updates so that your systems are protected as the threats came. While the upgrading is implying the new features

of the softwares or major improvement over your current version. In many cases, a software upgrade requires the purchase of the new version of the software.

DO'S & DON'T IN COMPUTER LABORATORY

For maintaining the Computer lab appropriately there should be some rules to be followed by everybody.

- Computers should be operated under normal room temperature. The room should not be too hot or too cold.
- The lab room's floor should be clean, dry and dust free.
- Eating and drinking is not allowed in the computer lab.
- Make sure all cables are insulated and that they do not criss cross in the path.
- After using the computer every machine should be turn off (shut-down) properly.
- No one is allowed to delete information from the computer unless given as an instruction.
- Only authorised persons may connect and disconnect any cables, devices, computers or anything in the computer lab.
- Every problem, challenge or mishap should be reported to the responsible authorities.
- External storage devices are not allowed to be brought into the laboratory for security, viruses, document and privacy infringement among other reasons.
- Do not upload unnecessary softwares they slow your machine.
- The location of the fire extinguisher and the first aid box must be known to all so that they can use in case of an emergency.
- Accessing Pornographic, Hate/Discrimination, torrent and other unsafe sites should be strictly prohibited.
- Proper computer laboratory etiquette must be observed by teachers.

These rules must be followed by all the stakeholders using computer laboratory and thus infrastructure will be maintained for longer time.

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Quadrant-IV

Assessment questions

1. When did ICT@Schools scheme was launched?

a. 2000

b. 2002

c. 2004

d. 2006

2. How many computers were provided initially to a school under ict@schools scheme?

a. 10

b. 12

c. 15

d. 20

3. What are the two main types of Software?

a. System & Application Software

b. Operating system & Windows

c. Device Drivers & Antivirus

d. None of the Above

4. What is hardware troubleshooting?

a. reviewing, diagnosing and identifying operational or technical problems

b. resolve physical and/or logical problems of hardware

c. Software related hardware problems

d. All of the above

5. Which storage device has shorter lifespan, small storage space and slower read and write speeds.

a. USB Drive

b. CDs/DVDs

c. Cloud

d. External Hard Disk

6. Upgrading means to add new features of the softwaresor improvement over current version. True/ False
7. Accessing Pornographic, Hate/Discrimination, torrent and other unsafe sites should be strictly prohibited in the school laboratory. True/ False
8. Google Drive is a USB Device. True/ False
9. Screen Readers is an assistive technology. True/ False
10. Web Browser is used for locating and retrieving files or resources on the World Wide Web. True/False

Answer

1. c, 2.a, 3.a, 4.d, 5.b, 6.True, 7.True, 8.False, 9.True,10. True.