RQF LEVEL 4

CSACR401

COMPUTER SYSTEM AND ARCHITECTURE

Computer System Refurbishment

TRAINEE'S MANUAL

October, 2024

COMPUTER SYSTEM REFURBISHMENT

KOICA Korea International Cooperation Agency

TQUM TVET Quality Management Project

2024

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ACRONYMS

AIO: All-in-One (refers to devices like printers or PCs that combine multiple functions)
AMD: Advanced Micro Devices
ATX: Advanced Technology eXtended
BDD: Behavior-Driven Development
BIOS: Basic Input/Output System
CAD: Computer-Aided Design
CBT/A: Competency Based Training/Assessment
CD: Compact Disc
CD-ROM: Compact Disc Read-Only Memory
CI/CD: Continuous Integration/Continuous Deployment
CMOS: Complementary Metal-Oxide-Semiconductor
DDR4: Double Data Rate 4 (fourth generation)
DIMM: Dual In-line Memory Module
DVD: Digital Versatile Disc (or Digital Video Disc)
ESD: Electrostatic Discharge
GPU: Graphics Processing Unit
HDMI: High-Definition Multimedia Interface
HHD: Hybrid Hard Drive
HPC: High-Performance Computing
HPE: Hewlett Packard Enterprise
I/O: Input/Output
IC: Integrated Circuit
ICT: Information and Communication Technology
ICT: Information and Communication Technology
IDE: Integrated Drive Electronics
IoT: Internet of Things
IT: Information Technology
ITX: Information Technology eXtended
KOICA: Korea International Cooperation Agency
LED: Light Emitting Diode
MOSFET: Metal-Oxide-Semiconductor Field-Effect Transistor
NET: Network
NVMe: Non-Volatile Memory Express
OMR: Optical Mark Recognition
OS: Operating System
PCB: Printed Circuit Board
PCs: Personal Computers

PCU: Power Control Unit
POST: Power-On Self-Test
PPE: Personal Protective Equipment
PSU: Power Supply Unit
RAM: Random Access Memory
RGB: Red, Green, Blue (refers to the color model used in electronic
ROM: Read-Only Memory
RTB: Rwanda TVET Board
SATA: Serial Advanced Technology Attachment
SDLC: Software Development Life Cycle
SDN: Software-Defined Networking
SFF: Small Form Factor
SSD: Solid State Drive
TDD: Test-Driven Development
TQUM Project: TVET Quality Management Project
UAT: User Acceptance Testing
UEFI: Unified Extensible Firmware Interface
USB: Universal Serial Bus
VMware: Virtual Machine Software (named after the company, VMware)
Wi-Fi: Wireless Fidelity

INTRODUCTION

This trainee's manual includes all the knowledge and skills required in computer system and architecture specifically for the module of **"Computer System Refurbishment".** Students enrolled in this module will engage in practical activities designed to develop and enhance their competencies. The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

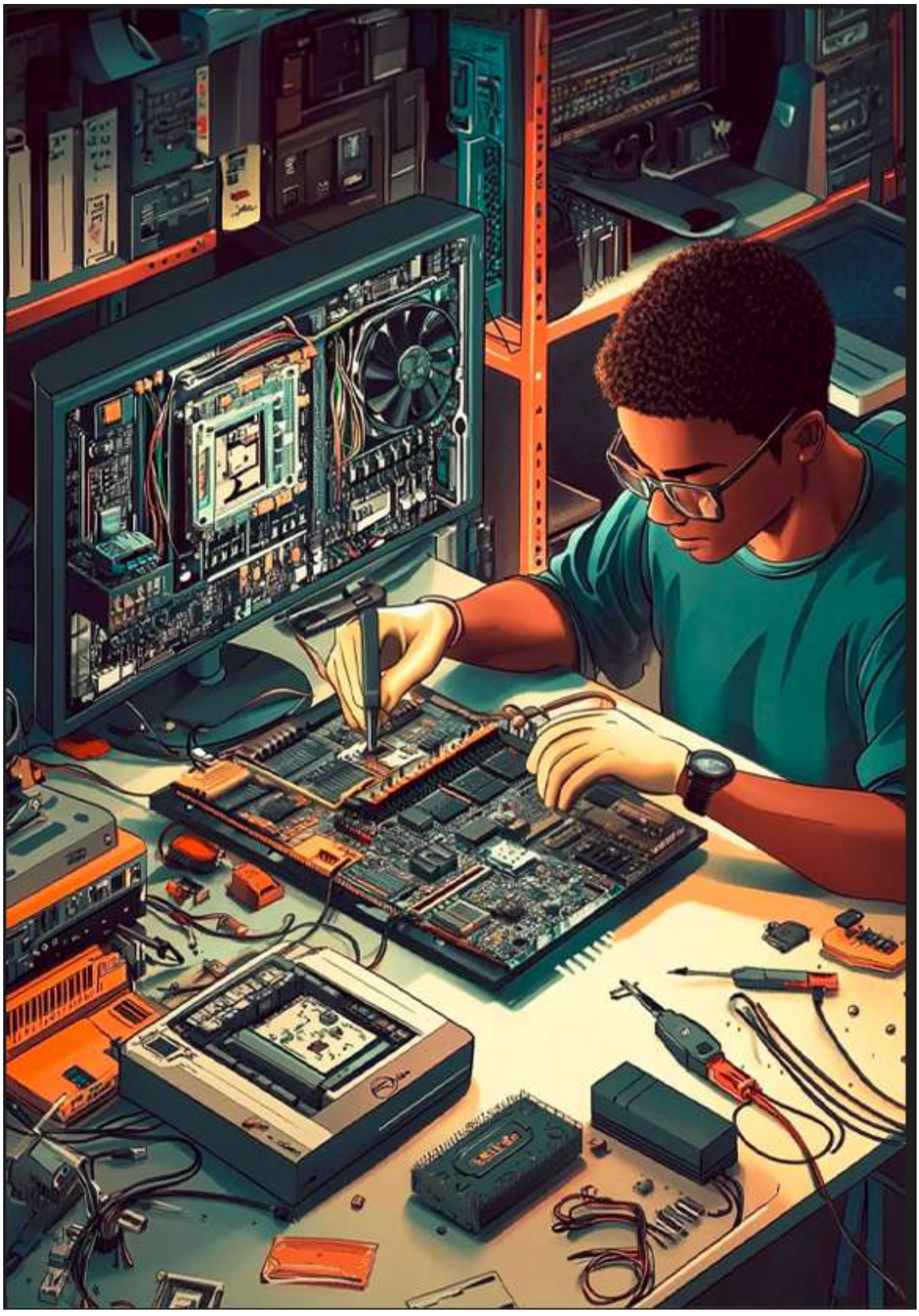
The trainee's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainee, you will start by addressing questions related to the activities, which are designed to foster critical thinking and guide you towards practical applications in the labour market. The manual also provides essential information, including learning hours, required materials, and key tasks to complete throughout the learning process.

All activities included in this training manual are designed to facilitate both individual and group work. After completing the activities, you will conduct a formative assessment, referred to as the end learning outcome assessment. Ensure that you thoroughly review the key readings and the 'Points to Remember' section.

MODULE CODE AND TITLE: CSACR401 COMPUTER SYSTEM REFURBISHMENT

Learning Outcome 1: Perform computer system renovation.
Learning Outcome 2: Perform computer system restoration.
Learning Outcome 3: Perform computer system Conversion.



Indicative Contents

1.1 Setting Working Place.

1.2 Selection of Computer System Components

1.3 Selection of Tools, Materials and Equipment.

1.4 Disassembling Computer System

1.5 Installation of New Hardware Component

1.6 Assembling Computer System

1.7 Installation of Computer System Drivers and Software

1.8 Perform Computer System Test

Key Competencies for Learning Outcome 1: Perform Computer System Renovation

Knowledge	Skills	Attitudes
• Description of working place • Description of computer system components • Description of computer system test	• Setting a working place • Selecting a computer system component • Assembling computer components • Disassembling computer component • Installing a new hardware component • Upgrading a computer hardware component • Testing computer system	• Being Innovative • Being organized • Having Flexibility • Having Time Management • Being Problem Solver • Having Team work spirit • Being Hard worker • Being Self-motivated

Duration: 20 hrs

Learning outcome 1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe properly working place according to occupation safety and health standards.
2. Describe properly computer system components based on system requirement.
3. Describe properly Description of computer system test according to computer unit testing requirement.
4. Select properly computer system component based on system requirement.
5. Disassemble correctly computer system based on its structure.
6. Assemble correctly computer system based on renovation requirement.
7. Install properly new hardware components based on computer system requirement.
8. Install properly system software based on computer system requirement.
9. Test effectively computer system according to the computer unit

Resources

Equipment	Tools	Materials
• Power supply tester • Oscilloscope • Multi-meter • Blower • Computer	• Screwdrivers • Tweezers • Flashlight or headlamp • Cable testers • Thermal paste applicator • Pliers • ESD Tools	• Thermal paste • Isopropyl alcohol and cotton swabs • Electrical tape and zip ties • Spare screws • Labelling materials

Indicative content 1.1: Setting Working Place.

Duration: 2 hrs

Theoretical Activity 1.1.1: Description of working place

Tasks:

1: Answer the following questions:

i. Define the following:

a. Workplace in computer system
b. Hazard
c. Safety measure
d. PPE
e. Ergonomics
f. Hygiene and sanitation

ii. What are the safety measures applied in computer refurbishment?

iii. What are the types of hazards?

2: Provide the answers for the asked questions and write them on flipchart/papers.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.1.1.

Key readings 1.1.1: Description of working place

1. Setting Working Place

A "working place" or "workplace" In computer refurbishment, a workplace typically refers to a facility or area where used or damaged computers are repaired, upgraded, and resold.

2. **Hazard**

A **hazard** is anything that has the potential to cause harm, injury, illness, damage, or adverse effects to people, property, or the environment.

Types of Hazards:

a. Biological: Hazards that involve exposure to harmful biological agents.
Example: bacteria, viruses, insects, plants, birds, animals, and humans, etc.,
b. Chemical: Hazards that come from chemical substances that can cause harm through exposure.
Example: depends on the physical, chemical and toxic properties of the chemical,

c. Ergonomic: Hazards that arise from the design of work tasks or workstations that can lead to musculoskeletal injuries.

Example: repetitive movements, improper set up of workstation, etc.,

d. Physical: Hazards that involve environmental factors that can harm an employee without necessarily touching them.

Example: radiation, magnetic fields, temperature extremes, pressure extremes (high pressure or vacuum), noise, etc.,

e. Psychosocial: Hazards that arise from workplace stressors that can affect mental health and well-being.

Example: stress, violence, etc.,

3. Safety measures in computer system:

1. Provide Personal Protective Equipment (PPE)

Personal Protective Equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards

TYPES OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment (PPE) is required in any situation in which the hazard in question cannot be completely removed or controlled in such a way that serious harm is unlikely. Without the appropriate PPE, your workers are left exposed to significant injury or illness, including radiation exposure, chemical burn, electrical shock, and more. Depending on the hazard or workplace conditions, the Occupational Safety and Health Administration (OSHA) recommends different protective equipment to manage or eliminate the hazard to the greatest extent possible.

1. Head Protection

Head protection is required for all employees working in areas where there is potential danger of head injury from impact, electrical shock or burns, or falling or flying objects. Examples of head protection PPE include helmets, hard hats, bump caps, guards, and more. Such protective helmets are designed to absorb the shock of a blow and resist penetration by falling or flying objects.

2. Hearing Protection

Hearing protection is vital for those working in an environment with high-sound levels where it's not feasible to reduce the level of noise or duration of exposure. Examples of hearing protection include earplugs, noise meters, acoustic foam, and communications sets. Plain cotton is never an acceptable protection device as the equipment should provide an adequate level of protection, hygiene, and comfort to its user

.

3. Eye and Face Protection

Eye and face protection is necessary when workers are exposed to eye or face hazards from liquid chemicals, acids, chemical gases, molten metal, light radiation, and flying particles. Examples of eye and face PPE include visors, over specs, eye and face shields, eyewear accessories, safety glasses, and goggles. Common activities that necessitate the use of eye and face protection include welding, working with lasers, heavy cutting, the use of gas under pressure, and the handling of hazardous substances.

4. Respiratory Protection

Respiratory protection covers a broad range of equipment that should be used when workers may come into contact with large amounts of harmful dusts, fogs, mists, fumes, vapors, powders, or gases. The goal is to protect the health of your employees by preventing atmospheric contamination. This type of equipment may include face masks, detectors, protective hoods, respirators, helmets, and more.

5. Hand Protection

Last but certainly not least, hand protection equipment is necessary to protect your workers against cuts, lacerations, punctures, abrasions, chemical burns, thermal burns, and harmful temperature extremes. Common activities that may require hand protection equipment include working in hot or cold environments, manually handling sharp objects, and working with hazardous chemicals

6. **ESD (Electrostatic Discharge) mats and wrist straps:** Prevent electrostatic discharge that can damage electronic components.

2. **Ergonomics**

Ergonomics refers to the design and arrangement of computer systems, devices, and workspaces to optimize human well-being and performance. The goal of ergonomic design in ICT is to create a comfortable and efficient working environment that minimizes the risk of discomfort, fatigue, and injury for users.

3. Electrical Safety

Electrical safety is a paramount concern when working with computers, especially when refurbishing them. Improper handling can lead to electrical shocks, fires, or damage to the equipment.

Types of Electrical Hazard Situations

Contact with Energized Sources

Hazards regarding contact with energized sources are electrical shock and burns. Electrical shock occurs when the body becomes part of the electric circuit (when an individual comes in contact with both wires of an electrical circuit, one wire of an energized circuit and the ground, or a metallic part that has become energized by contact with an electrical conductor).

Contact with Power Lines

Overhead and buried power lines are hazardous because they carry extremely high voltage. Fatalities are possible as electrocution is the main risk; however, burns and falls from elevations are also hazards that worker are exposed to while working in the vicinity of high voltage power lines.

Improper Use of Extension and Flexible Cords

Normal wear and tear on extension and flexible cords can loosen or expose wires, creating a hazardous condition. Hazards are created when cords, cord connectors, receptacles, and cord- and plug connected equipment are improperly used and maintained. If the electrical conductors become exposed, there is a danger of shocks, burns, or fire.

4. Fire Safety

Fire safety is the set of practices intended to reduce destruction caused by fire. Fire safety measures include those that are intended to prevent the ignition of an uncontrolled fire and those that are used to limit the spread and impact of a fire.

Things a Fire Needs

The 3 things a fire needs are heat, fuel and oxygen. These three elements work together to help a fire start and take over. However, if any of the three elements are removed from a fire, then it will extinguish and no longer pose a threat.

1. Heat

Heat is the first and most essential element that a fire needs. his provides the initial spark or source of ignition to start the fire and raise the fuel temperature to its burning point. Examples include flames, sparks, matches, electrical equipment malfunctions, and even sunlight under certain conditions.

2. Fuel

Fuel is the second element found in the fire triangle. The fire will need a fuel source in order to continue to burn. The fuel can be anything that's flammable such as paper, wood, fabric, chemicals or combustible materials. If you remove the fuel from the fire, then it will go out.

3. Oxygen

Oxygen is the last element in the fire triangle. It's also one of the more important factors because oxygen is everywhere. A fire needs oxygen in order to ignite and continue to burn. So to put out a fire you can use dirt, sand or a non-flammable blanket to smother the fire.

Here's a guide to fire extinguisher types and classes, incorporating images for clarity:

Classes of Fires:

- **Class A**: Ordinary combustibles like wood, paper, cloth, and plastics.

Class A fire symbol

- **Class B**: Flammable liquids like gasoline, oil, paint, and solvents.

Class B fire symbol

- **Class C**: Electrical fires involving energized equipment.

Class C fire symbol

• **Class D**: Combustible metals like magnesium, potassium, and sodium (less common).

Class D fire symbol

• **Class K**: Cooking oils and fats (kitchen fires).

Class K fire symbol

- **Types of Fire Extinguishers**

1. Water Extinguishers:

- Use for: Class A fires only.
- How they work: Cool the burning material and smother the flames.

Image:

Water fire extinguisher

2. Foam Extinguishers:
   - Use for: Class A and B fires.
   - How they work: Create a foam blanket to smother the flames and prevent re-ignition.
   - Image:

Foam fire extinguisher

3. Dry Chemical Extinguishers (ABC):
   - Use for: Class A, B, and C fires.
   - How they work: Disrupt the chemical reaction of the fire, smothering the flames.
   - Image:

Dry chemical fire extinguisher

4. Carbon Dioxide (CO_2) Extinguishers:

- Use for: Class B and C fires.
- How they work: Displace oxygen and smother the flames.
- Image:

Carbon dioxide fire extinguisher

5. Wet Chemical Extinguishers:

- Use for: Class K fires (kitchen fires).
- How they work: Cool the burning oil and create a soap-like barrier to prevent re-ignition.
- Image:

5. Hygiene and Sanitation

Maintaining a clean and hygienic workplace is not just about aesthetics; it plays a crucial role in preventing accidents, illness, and injuries, ultimately contributing to a safer and more productive work environment.

Hygiene and Sanitation

Maintaining a clean and hygienic workplace is not just about aesthetics; it plays a crucial role in preventing accidents, illness, and injuries, ultimately contributing to a safer and more productive work environment. Here's how hygiene and sanitation act as essential safety measures at work:

Hygiene:

Handwashing: Frequent handwashing with soap and water, especially after using the restroom, handling food, or dealing with waste, is crucial for preventing the spread of germs and bacteria that can cause illnesses like flu, colds, and even foodborne diseases.

Handwashing with soap and water

- **Personal cleanliness:** Encouraging employees to maintain personal hygiene through showering or bathing regularly, wearing clean clothes and shoes, and keeping facial hair and nails trimmed can prevent infections and skin irritations.
- **Respiratory hygiene:** Covering coughs and sneezes with a tissue or elbow can help prevent the spread of airborne illnesses.
- **Workplace cleanliness:** Regularly cleaning and disinfecting common surfaces like doorknobs, desks, shared equipment, and restrooms reduces the risk of cross-contamination and potential outbreaks.

Sanitation:

- **Proper waste disposal:** Having readily available and designated waste bins for different types of waste, including recycling bins, prevents clutter and ensures proper disposal, minimizing the risk of attracting pests and creating unsanitary conditions.

Recycling bin

Clean and maintained restrooms: Regularly cleaning and sanitizing restrooms, providing adequate toilet paper and handwashing facilities, and ensuring proper ventilation are essential for maintaining hygiene and preventing the spread of germs.

- **Safe water supply:** Access to clean and safe drinking water is crucial for employee health and hydration. This can be achieved through providing filtered water stations or bottled water.
- **Proper ventilation and air quality:** Maintaining proper ventilation and air quality through regular cleaning of air ducts and filters, as well as controlling dust and fumes from certain work processes, can prevent respiratory problems and illnesses.

Benefits of prioritizing hygiene and sanitation at workplace:

- **Reduced absenteeism*:*** By preventing illness and injuries, good hygiene and sanitation practices can lead to lower absenteeism rates, boosting productivity and minimizing disruptions.
- **Improved employee morale*:*** A clean and hygienic workplace can contribute to a more positive and comfortable work environment, leading to improved employee morale and satisfaction.
- **Enhanced safety*:*** Implementing proper hygiene and sanitation measures can help prevent slips, trips, and falls caused by spills or cluttered workspaces.
- **Stronger company image*:*** A commitment to hygiene and sanitation demonstrates a company's care for its employees and promotes a positive brand image.

Practical Activity 1.1.2: Setting the workplace

Task:

1. Read the key reading 1.1.2
2. Referring to the key reading 1.1.2 you are requested to go in computer lab to set workplace.
3. Present your work to the trainer and whole class.
4. In addition, ask questions where necessary.

Key readings 1.1.2: Setting the workplace.

1.Setting Up a Workspace for Computer System Refurbishment

1. Choose a Suitable Location:

- **Adequate space:** Ensure you have enough room to spread out components and work comfortably.
- **Ventilation:** Choose a well-ventilated area to avoid exposure to harmful fumes.
- **Lighting:** Good lighting is essential for precise work.
- **Power outlets:** Ensure there are sufficient power outlets to accommodate your equipment.

2. Organize Your Workspace:

- **Clear work surface:** Keep your workspace clean and free of clutter.
- **Designated areas:** Create designated areas for different tasks, such as disassembly, cleaning, and reassembly.
- **Storage solutions:** Use shelves, drawers, or boxes to store tools, components, and cleaning supplies.

3. Equip Your Workspace:

- **Essential tools:** Gather necessary tools like screwdrivers, pliers, tweezers, and a toolkit.
- **Cleaning supplies:** Have cleaning solutions, microfiber cloths, and brushes on hand.
- **Protective gear:** Keep safety glasses, gloves, and a dust mask readily available.
- **Work mat or bench:** A padded work surface can protect components and provide comfort.

4. Safety Considerations:

- **Electrical safety:** Always unplug equipment before working on it.
- **Ground yourself:** Use a grounding wrist strap to prevent electrostatic discharge.
- **Ventilation:** Ensure proper ventilation when using cleaning chemicals.
- **Fire safety:** Keep a fire extinguisher nearby and be aware of exit routes.

5. Ergonomics:

- **Proper posture:** Sit upright and avoid straining your neck, back, or wrists.
- **Monitor placement:** Position your monitor at eye level to reduce strain.
- **Keyboard and mouse placement:** Keep your keyboard and mouse at a comfortable distance and height.
- **Take breaks:** Get up and stretch regularly to avoid fatigue.

1. **Implement safety measures in computer refurbishment**

   Implementing safety measures in computer refurbishment is essential to protect both learners and the equipment involved. Here are the steps you can take:

1. Conduct a Risk Assessment: Identify potential hazards associated with the refurbishment process, such as electrical risks, exposure to hazardous materials (like old batteries), and ergonomic concerns.
2. Develop a Safety Plan: Create a detailed safety plan that outlines specific safety protocols and procedures for handling equipment, tools, and hazardous materials during refurbishment.
3. Use Personal Protective Equipment (PPE): Equip learners with appropriate PPE, such as gloves, safety glasses, and anti-static wrist straps, to protect against electrical shocks and static discharge.
4. Ensure Proper Ventilation: If refurbishing computers involves cleaning with solvents or other chemicals, ensure that the workspace is well-ventilated to minimize exposure to harmful fumes.
5. Maintain Cleanliness and Organization: Keep the work area tidy and organized to prevent accidents. Properly label and store tools and components to reduce the risk of mishandling.

Points to Remember

- A "working place" or "workplace" In computer refurbishment, a workplace typically refers to a facility or area where used or damaged computers are repaired and upgraded.
- There are different safety measures applied in computer refurbishment such as: Electrical Safety, Component Handling, Physical Safety, Chemical Safety and Data Security
- There are different types of hazards which are: Biological, Chemical, Ergonomic, Physical, Psychosocial
- Steps for Setting Up a Workspace for Computer System Refurbishment

1. Choose a Suitable Location
2. Organize Your Workspace
3. Equip Your Workspace
4. Safety Considerations
5. Ergonomics

Application of learning 1.1.

XYZ Company, which specializes in refurbishing computers, is setting up a new workspace for their technicians in computer system refurbishment, you have been tasked to set the workspace and implement safety measures.

Indicative content 1.2: Selection of Computer System Components

Duration: 3 hrs

Theoretical Activity 1.2.1: Description of computer system hardware

Tasks:

1: Answer the following questions:

i. What are the components of computer system hardware?

ii. What are the components of CPU?

iii. What are the types of software?

2: Provide the answers for the asked questions and write them on flipchart/papers.

3: Present the findings/answers to the whole class.

4: In addition, ask questions where necessary.

5: For more clarification, read the key readings 1.2.1.

Key readings 1.2.1.: Description of computer system hardware

Computer Hardware:

Computer hardware refers to the tangible, physical components of a computer system. These components can be seen, touched, and manipulated, and they work together to process information and perform various tasks

1. hardware Computer System Components

Here are some of the essential internal components found in a typical computer system:

1.1 Central Processing Unit (CPU)

The "brain" of the computer, responsible for executing instructions and performing calculations.

Examples: Intel Core i7, AMD Ryzen 9

1.2 Motherboard

The **motherboard** is the main circuit board in a computer that connects and allows communication between all the critical components. It serves as the central platform that houses and interlinks the CPU, memory (RAM), storage devices, and other peripherals.

Components of Motherboard:

CPU Socket: A slot that holds the CPU and connects it to the motherboard's circuitry.

RAM Slots: Slots where memory (RAM) modules are inserted for temporary data storage.

Chipset: Controls communication between the CPU, RAM, and other components; determines the motherboard's features and capabilities.

Expansion Slots: These include PCIe slots for adding components like graphics cards, sound cards, or network adapters.

Storage Connectors: SATA and M.2 connectors allow connection of hard drives, SSDs, and other storage devices.

Power Connectors: Provide power to the motherboard and connected components.

I/O Ports: External ports for USB devices, audio, Ethernet, and other peripherals

1.3 Storage and memories

1.3.1 Storage

Hard Disk Drive (HDD): This is like a traditional filing cabinet. It's slow but can store a lot of data.

Solid-State Drive (SSD): This is like a digital filing cabinet. It's much faster than an HDD but is more expensive.

1.3.2 Memory

Random Access Memory (RAM): This is like your workspace. It's fast but only holds data temporarily while you're working on it.

Read-Only Memory (ROM): This is like a reference book that you can't change. It stores essential instructions for the computer to start.

Difference between RAM and ROM

Aspect	RAM (Random Access Memory)	ROM (Read-Only Memory)
Full Form	Random Access Memory	Read-Only Memory
Primary Function	Temporarily stores data and instructions for quick access	Permanently stores essential system instructions
Volatility	Volatile (data is lost when power is off)	Non-volatile (retains data even when power is off)
Write/Modify Capability	Read and write memory	Typically read-only; can be rewritten in some cases (EEPROM, Flash)
Speed	Much faster, used for active tasks	Slower compared to RAM
Usage	Stores data being actively used by the CPU (e.g., programs)	Stores firmware and bootloader, essential system data
Data Retention	Temporary, cleared when device is powered off	Permanent, even without power
Size	Typically larger in size (GBs)	Smaller in size (MBs to GBs)
Cost	More expensive per unit size	Less expensive per unit size

1.4. Input devices/ output devices

1.4.1 Input Devices

Input devices are used to provide information to the computer. They enable the user to enter data, commands, or instructions into the system.

Common examples include:

- ✓ Keyboard: Used to enter text, numbers, and commands.
- ✓ Mouse: Used to navigate the screen, select items, and perform actions.
- ✓ Touchscreen: Allows users to interact with the computer by touching the screen.
- ✓ Scanner: Converts physical documents into digital images.
- ✓ Microphone: Captures audio input for sound recording or voice recognition.
- ✓ Webcam: Captures video input for video conferencing or recording.
- ✓ Game Controllers: Specialized input devices used for gaming.

1.4.2 Output Devices

Output devices are used to display or present information from the computer to the user. They allow the computer to communicate its results or output. Some common output devices include:

Monitor: Displays visual information, such as text, images, and videos.

Printer: Produces physical copies of digital documents.

Speakers: Output audio signals, such as music, speech, or sound effects.

Projector: Displays visual information on a large screen.

Headphones: Deliver audio output directly to the user's ears.

1.5 Adapter Cards

Adapter Cards: Expanding Your PC's Capabilities

Adapter cards, also known as expansion cards or add-in cards, are hardware components that you insert into expansion slots on your computer's motherboard to enhance its functionality. These cards provide additional capabilities that the motherboard alone cannot offer.

Common Types of Adapter Cards:

Graphics Cards:

Enhance the graphics processing capabilities of your PC.

Used for demanding tasks like gaming, video editing, and 3D rendering.

Examples: NVIDIA GeForce, AMD Radeon

Sound Cards:

Improve the audio quality of your PC's sound output.

Offer advanced features like surround sound, audio effects, and digital audio interfaces.

Examples: Creative Sound Blaster, ASUS Xonar

Network Cards:

Provide network connectivity, allowing your PC to connect to the internet or a local network.

Can be wired (e.g., Ethernet) or wireless (e.g., Wi-Fi).

Examples: Intel Ethernet, TP-Link Wi-Fi

TV Tuner Cards:

Allow you to watch digital television on your PC.

Can capture and record TV programs.

Examples: Hauppauge WinTV, AverMedia TV Tuner

Capture Cards:

Used to capture video or audio from external sources, such as game consoles or camcorders.

Commonly used for video editing and streaming.

Examples: Elgato Game Capture, AverMedia Live Gamer

Modem Cards:

Provide dial-up internet connectivity.

Less common nowadays due to the prevalence of broadband internet.

1.6 Power Supply Unit (PSU)

Power Supply Unit (PSU) The Power Supply Unit (PSU) is a crucial component of a computer system that converts AC power from the wall outlet into DC power required by internal components such as the CPU, motherboard, and peripherals. It ensures that your PC receives a stable and reliable power supply for optimal performance.

Key Functions:

Voltage Conversion: The PSU converts the incoming AC voltage (typically 110V or 220V) into DC voltages that are compatible with the various components within the PC. Common DC voltages include 3.3V, 5V, and 12V.

Current Regulation: It regulates the current output to prevent overloading and damage to components.

Power Distribution: The PSU distributes power to different components within the system based on their requirements.

Protection: It provides protection against power surges, voltage fluctuations, and short circuits to safeguard your PC's components.

Types of PSUs:

ATX (Advanced Technology eXtended): The most common type of PSU used in modern desktop PCs.

Server PSUs: Designed for high-performance servers and workstations, offering higher power output and redundancy features.

Mini-ITX PSUs: Smaller and more compact PSUs suitable for small form factor (SFF) systems.

2. The components of CPU

The **components of the CPU** are the key elements that work together to perform processing tasks. These include:

2.1 Control Unit (CU): Directs the operation of the processor by managing the execution of instructions and coordinating communication between the CPU and other components.

2.2 Arithmetic Logic Unit (ALU): Performs mathematical calculations (arithmetic) and logical operations (comparisons and decision-making).

2.3 Registers: Small, fast storage areas inside the CPU used to temporarily hold data and instructions that are currently being processed.

2.4 Cache: A small, high-speed memory located in the CPU that stores frequently accessed data and instructions to reduce the time it takes to fetch information from RAM.

2.5 Bus Interface Unit: Manages data transfer between the CPU and other components via buses, ensuring smooth communication across the system.

3. Types of Software

3.1 Software:

Software is the set of instructions, data, or programs used to operate computers and execute specific tasks. It's the intangible counterpart to hardware.

Here are types of software:

System Software:

Purpose: Manages and operates the computer hardware, enabling it to function and provide a platform for running other software.

Examples: Operating systems (like Windows, macOS, Linux), drivers, and utilities.

Function: It runs in the background to control hardware and ensure everything works together (e.g., managing memory, processors, input/output devices).

3.2 Application Software:

Purpose: Helps users perform specific tasks or activities, like writing documents, browsing the internet, or editing photos.

Examples: Microsoft Word, Google Chrome, Adobe Photoshop, video games.

Function: It's used directly by users to carry out tasks on the computer (e.g., writing a report, playing a game, or editing a video).

Practical Activity 1.2.2: Selecting computer system components

Task:

1. Read the key reading 1.2.2
2. Referring to the key reading 1.2.2, you are requested to select the computer components.
3. Present your work to the trainer and whole class.
4. In addition, ask questions where necessary.

Key readings 1.2.2: Selecting computer system components assembling

Steps for selecting computer components

Hardware

Selecting computer components can be an exciting yet challenging task. Here's a step-by-step guide to help you through the process:

1. **Determine Your Purpose:** Identify what you will primarily use the computer for (gaming, content creation, general use, etc.). This will influence your component choices.
2. **Choose a CPU (Processor):** The CPU is the brain of your computer. Look for one that matches your needs in terms of performance and compatibility with other components. Popular brands include Intel and AMD.
3. **Select a Motherboard**: Ensure the motherboard is compatible with your chosen CPU. Consider factors like size (ATX, microATX), features (Wi-Fi, Bluetooth), and expansion slots.
4. **Pick RAM (Memory):** Decide how much RAM you need based on your usage. For gaming or heavy multitasking, 16GB is often recommended, while 8GB may suffice for general use.
5. **Choose a GPU (Graphics Card):** If you plan to game or do graphic-intensive work, a dedicated GPU is essential. Research models that fit your budget and performance needs.
6. **Storage Options**: Decide between SSDs (faster, more expensive) and HDDs (slower, more storage for less money). Many users opt for a combination of both.

Select a Power Supply Unit (PSU): Choose a PSU with enough wattage to support your components, preferably with some headroom for future upgrades. Look for reputable brands with good efficiency ratings.

1. **Consider Cooling Solutions:** Depending on your CPU and GPU, you may need additional cooling. Stock coolers may suffice, but aftermarket coolers can improve performance and noise levels
2. **Choose a Case**: Select a case that fits your components and has good airflow. Consider aesthetics, size, and cable management options.
3. **Peripherals and Accessories**: Don't forget about the monitor, keyboard, mouse, and any other peripherals you may need. Ensure they are compatible and meet your preferences

II. Steps for selecting computer components

Software:

Selecting computer components based on the software you intend to use involves understanding the specific requirements and recommendations of that software. Here's a step-by-step guide to help you choose the right components tailored to your software needs:

1. Determine Software Requirements:

Research the software you plan to use (e.g., IDEs, design software, game engines, and virtual machines).

Check the official documentation for minimum and recommended system requirements.

2. Identify Key Performance Areas:

Understand which components are most critical for the software. For example, CPU performance is crucial for compilation speeds, while RAM is important for multitasking and handling large datasets.

3. Define Your Use Case:

Clarify what you'll be doing with the software (e.g., programming, graphic design, video editing). This will influence your component choices.

4. Select the CPU:

Choose a CPU that meets or exceeds the software's requirements. For tasks like software development or video editing, consider a multi-core processor for better performance.

5. Choose RAM:

Opt for sufficient RAM based on the software's requirements. For most development tasks, 16GB is a good starting point, while more demanding applications may require 32GB or more.

6. Pick Storage Solutions:

Select an SSD for your operating system and software to ensure fast load times and responsiveness. Depending on your storage needs, consider adding an HDD for larger files and projects.

7. Select a Graphics Card (GPU):

If your software relies heavily on graphics (like game development or 3D rendering), choose a dedicated GPU that meets the software's specifications. For general programming tasks, integrated graphics may be sufficient.

8. Choose a Motherboard:

Ensure the motherboard is compatible with your CPU and has the necessary features (like USB ports, expansion slots) for your needs. Check for future upgrade options as well.

9. Pick a Power Supply (PSU):

Choose a PSU that provides adequate wattage for your components and is from a reputable brand. Look for efficiency ratings (like 80 PLUS) to ensure reliability.

Points to Remember

- **Computer hardware** refers to the tangible, physical components of a computer system. These components can be seen, touched, and manipulated, and they work together to process information and perform various tasks.
- **Software** is the set of instructions, data, or programs used to operate computers and execute specific tasks. It's the intangible counterpart to hardware.
- **Steps for selecting computer components.**
    1. Determine Your Purpose
    2. Choose a CPU (Processor)
    3. Select a Motherboard
    4. Pick RAM (Memory)
    5. Choose a GPU (Graphics Card)
    6. Storage Options
    7. Select a Power Supply Unit (PSU)
    8. Consider Cooling Solutions
    9. Choose a Case
    10. Peripherals and Accessories

Application of learning 1.2

XYZ is a refurbish company wishes to set up new workstation for their employees in different departement each workstation must meet specific performance requirements. You asked to select computer system components that is reliable and match the Perfomence needs of each role of each office.

Indicative content 1.3: Selection of Tools, Materials and Equipment

Duration: 2 hrs

Theoretical Activity 1.3.1: Description of tools, materials and equipment

Tasks:

1: Answer the following questions:

i. Identify the types of tools used in computer system refurbishment
ii. Differentiate the thermal paste material from adhesive material
iii. Enumerates at least two examples of power protection device

2: Provide the answers for the asked questions and write them on flipchart/papers.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 1.3.1.

Key readings 1.3.1.: Description of tools, materials and equipment

1. **Tools**:

Devices used to perform specific tasks or operations. They are often handheld and designed to assist in manipulating materials or applying force.

1.1 Types of Tools:

1.1.1 ESD (Electrostatic Discharge) tools are specialized equipment designed to safely handle electronic components and devices while minimizing the risk of damaging them due to electrostatic discharge.

Examples:

ESD Wrist Straps:

These are worn on the wrist and connected to a ground point to safely discharge static electricity from the body while working on electronic components.

ESD Mats:

These mats are placed on work surfaces to provide a static-free area for handling sensitive components. They are typically grounded to prevent the buildup of static electricity.

ESD Bags:

Specialized bags made from conductive materials that protect electronic components during storage and transport. They prevent static buildup and provide shielding from electromagnetic interference.

1.1.2 Hand tools: are manually operated devices or instruments designed to assist with various tasks, repairs, or manipulations of materials.

Screwdrivers (Phillips & Flathead) – For opening cases, removing or securing screws on components like hard drives, motherboards, and expansion cards.

Tweezers – Useful for handling small screws and delicate components in tight spaces.

Pliers (Needle-nose) – For gripping small parts or bending wires.

Hex/Allen Wrench Set – Used for specialized screws found in some computers.

Cable Ties – For organizing cables neatly during assembly.

1.1.3 Computer diagnostic tools are software programs or hardware devices designed to analyze and assess the performance, health, and functionality of a computer system.

Example:

A digital multimeter (DMM) is a versatile instrument used to measure various electrical properties, including voltage, current, and resistance. It can also perform other functions like testing continuity, measuring capacitance, and sometimes even temperature.

Digital multimeters are favored for their ease of use and clear digital displays, which make reading measurements straightforward. They're essential tools for electricians, engineers, and hobbyists working with electrical circuits.

1.1.4 Cleaning tools, in the context of computers and technology, refer to software applications or utilities that are used to optimize, declutter, and improve the performance of a computer system.

Examples:

Cleaning brush is a specialized tool designed to safely remove dust, dirt, and debris from delicate computer components and peripherals.

An **electrical blower** (often referred to as an **air blower**) is a tool that uses high-powered air to remove dust and debris from various surfaces and spaces.

b. Materials:

Substances or elements used to make or build something. Materials can be raw or processed and are used as the foundational components in various projects or products.

2.1 Thermal paste, also known as thermal compound, thermal grease, or thermal interface material (TIM), is a type of substance used in electronics and computer hardware to improve the thermal conductivity between two surfaces, typically a microprocessor (CPU or GPU) and its corresponding heatsink or cooling solution.

Cleaning Materials

Cleaning materials refer to various substances, tools, and equipment used for the purpose of cleaning and maintaining hygiene in different environments, whether it's in households, commercial spaces, industries, or healthcare facilities.

Example:

Compressed Air Canister – Blows dust and debris out of hard-to-reach areas inside the computer, such as fans, heat sinks, and ports.

Isopropyl Alcohol (at least 90%) – Used for cleaning thermal paste off CPUs and heatsinks, and for cleaning electronic components.

2.2 Adhesive materials

Adhesive materials, commonly known as adhesives, are substances used to bond or stick two or more surfaces together by forming a strong and durable connection.

Example:

Super Glue

Super glue, also known as cyanoacrylate adhesive, is a fast-drying adhesive that bonds materials quickly and securely.

Equipment

Equipment: Larger, often more complex items or systems used to perform specific tasks or functions.

1. Power protection devices

Power protection devices, also known as power protection equipment or power management devices, are devices designed to safeguard electronic and electrical equipment from power related issues or disruptions.

Example: stabilizer, fuse, circuit breaker

PPE stands for Personal Protective Equipment. It refers to specialized clothing or equipment worn by individuals to protect themselves from various hazards in the environment, workplace, or during specific activities.

Practical Activity 1.3.2: Selecting tools, materials and equipment

Task:

1: Read the key reading 1.3.2

2: Referring to the key reading 1.3.2 you are requested to select tools, materials and equipment.

3: Present your work to the trainer and whole class.

4: In addition, ask questions where necessary.

Key readings 1.3.2.: Selection of tools, materials and equipment

Identify the tools needed to complete the job safely and effectively. Consider the type of material, the environment, and any other factors that could impact safety. Use the right tool for the job: Always use the appropriate tool for the task at hand.

Here are practical steps to guide you through the selection process:

1. **Assess the System Requirements**

Determine the scope: Identify what needs to be refurbished (e.g., hardware components like the motherboard, CPU, storage, or peripherals).

Check the compatibility: Ensure that the new or replacement components are compatible with the existing system (e.g., RAM type, CPU socket, power supply).

Identify any faults: Run diagnostics to identify failing or damaged parts, which will help you choose the correct replacement tools and materials.

2. **Select the Necessary Tools**

Basic Hand Tools:

Screwdrivers (Philips and flathead): For removing screws on the case, components, and peripherals.

Antistatic wrist strap: To avoid static discharge that could damage sensitive electronic components.

Pliers and tweezers: Useful for handling small components or cables.

Thermal paste applicator: For reapplying thermal paste to CPUs or GPUs during reinstallation.

Advanced Tools (if needed):

Multimeter: To test power supply and component functionality.

Compressed air: For cleaning dust from components and fans.

Pry tools: To safely open cases or separate parts without damage.

3. **Identify Required Materials**

Replacement Parts:

New or refurbished components: Hard drives, RAM, CPUs, power supplies, or GPUs, depending on what's needed for the system.

Consumables:
Thermal paste: For reinstalling or upgrading the CPU cooler.
Cable ties: For neat cable management.
Dust filters: If the original system had poor airflow, consider adding or replacing these.
4. **Choose the Right Equipment**
Cleaning Equipment:
Isopropyl alcohol (90% or higher): For cleaning thermal paste off CPU or GPU surfaces.
Microfiber cloths: To clean delicate components without causing scratches.
Diagnostic Tools:
POST tester: To help troubleshoot hardware issues during the startup process.
External drive enclosure: To test hard drives or recover data without reinstalling them inside the computer.
Upgrade Equipment (if necessary):
SSD cloning kit: For transferring data from an old hard drive to a new SSD.
Power supply tester: To check if the PSU is working properly.
5. **Safety Considerations**
Always use an **antistatic mat** or **wrist strap** to prevent electrostatic discharge (ESD).
Ensure you work in a **well-ventilated** area, especially when using cleaning chemicals like isopropyl alcohol or compressed air.
Organize components in a clear, labeled workspace to avoid losing screws or parts.
6. **Plan for Disposal or Recycling**
Collect old, damaged components, batteries, and hazardous materials like old thermal paste for **proper disposal** or **recycling**.

Points to Remember

- There are four types of tools used in computer system refurbishment such as:
  ESD tools, hand tools, diagnostic tools and cleaning tools.
  The main difference between thermal paste and adhesive material lies in their purpose and properties:
  Thermal Paste:
- **Purpose**: Enhances heat transfer between a CPU/GPU and a cooler by filling in microscopic gaps.
- **Property**: It is non-adhesive, allowing components to be easily removed for maintenance. It does not bond parts together.
  Adhesive Material:

Purpose: Used to bond or stick two surfaces together.

- **Property**: It has adhesive qualities, creating a permanent or semi-permanent bond, making it harder to remove the components once applied.

In computer system refurbishment we may have the following examples of power protection device: Uninterruptible Power Supply (UPS), Surge Protectors, Power Conditioners, stabiliser, fuse and circuit breaker.

- **Practical steps to guide you through the selection process:**

1. Assess the System Requirements
2. Select the Necessary Tools
3. Identify Required Materials
4. Choose the Right Equipment
5. Safety Considerations
6. Plan for Disposal

Application of Learning 1.3

The IT department of a mid-sized company has decided to refurbish older computers to extend their lifespan and improve performance. You are requested to select the appropriate tools, materials, and equipment needed to carry out the refurbishment effectively.

Indicative content 1.4: Disassembling Computer System

Duration: 3 hrs

Theoretical Activity 1.4.1: Description of computer system disassembling

Tasks:

1: Answer the following questions:

I. What are the types of computers?
II. What are the categories of computers?
III. What are the computer system components?
IV. Differentiate assembling from disassembling computer

2: Provide the answers for the asked questions and write them on flipchart/papers.

3: Present the findings/answers to the whole class.

4: In addition, ask questions where necessary.

5: For more clarification, read the key readings 1.4.1.

Key readings 1.4.1.: Description of computer system

A computer system is a complex arrangement of hardware and software designed to process, store, and manage data and perform various tasks or computations.

1. Types of computers

1.1 Personal Computers (PCs):

Personal Computers is also known as a microcomputer. It is basically a general-purpose computer designed for individual use. It consists of a microprocessor as a central processing unit (CPU), memory, input unit, and output unit

1.2 Workstations:

More powerful than personal computers and designed for specialized tasks like computer-aided design (CAD), video editing, and scientific simulations.

1.3. Servers:

Designed to provide services and resources to other computers (clients) on a network.

Used for hosting websites, managing databases, file sharing, and more.

Offer high reliability, scalability, and redundancy.

1.4. Mainframes:

Extremely powerful and capable of handling complex and critical applications.

Commonly used in large organizations for handling massive volumes of data and transactions.

1.5. Supercomputers

The most powerful and high-performance computers available.

Used for complex scientific simulations, weather forecasting, and advanced research requiring massive computational power.

2. Categories of Computers

Computers can be classified based on their size, purpose, and processing power. Here are the main categories:

2.1 Based on Size and Processing Power

- **Supercomputers:** The most powerful computers, designed for complex calculations and simulations. They are used in scientific research, weather forecasting, and artificial intelligence.
- **Mainframes:** Large-scale computers used by businesses and organizations to handle massive amounts of data. They are often used for critical tasks like financial transactions and airline reservations.
- **Minicomputers:** Smaller than mainframes but still powerful, they are used for tasks like network administration and data management.
- **Workstations:** High-performance computers designed for specific tasks, such as engineering, design, and video editing.
- **Personal Computers (PCs):** The most common type of computer, used for a wide range of tasks, from word processing to gaming.
  - **Desktop Computers:** Stationary computers designed to be used at a desk.
  - **Laptops:** Portable computers that can be used on the go.
  - **Tablets:** Smaller, touchscreen devices that are primarily used for mobile computing.
  - **Smartphones:** Mobile phones with advanced computing capabilities.

2.2 Based on Purpose

- **Servers:** Computers that provide services to other computers on a network, such as file storage, email, and web hosting.
- **Embedded Systems:** Small computers built into other devices, such as cars, appliances, and medical equipment.
- **Gaming Consoles:** Specialized computers designed for playing video games.

2.3 Based on Function

- **Analog Computers:** Process continuous data, such as electrical signals.
- **Digital Computers:** Process discrete data, represented as 0s and 1s.
- **Hybrid Computers:** Combine analog and digital components.

3. Computer System Components

A computer system is composed of various components that work together to perform tasks.

3.1 **Hardware Components**

Central Processing Unit (CPU): Often referred to as the "brain" of the computer, the CPU executes instructions and performs calculations.

Motherboard: The main circuit board that connects all the components of the computer.

Memory: Stores data and instructions temporarily while the computer is running.

Random Access Memory (RAM): Volatile memory that loses its contents when the computer is turned off.

Read-Only Memory (ROM): Non-volatile memory that stores permanent data.

Storage Devices: Store data permanently.

Hard Disk Drive (HDD): Traditional storage device with spinning disks.

Solid-State Drive (SSD): Faster storage device with no moving parts.

Input Devices: Devices used to enter data into the computer.

Keyboard: For typing text.

Mouse: For navigating the computer's interface.

Scanner: For converting physical documents into digital images.

Output Devices: Devices used to display or output data.

Monitor: For displaying visual information.

Printer: For printing documents on paper.

Speakers: For producing sound.

3.2. Software Components

Operating System: The software that manages the computer's resources and provides an interface for users to interact with the computer:

- **Windows:** A popular operating system for personal computers.
- **MacOS:** The operating system for Apple computers.
- **Linux:** A free and open-source operating system.

Applications: Software programs designed to perform specific tasks:

- **Word processors:** For creating and editing documents.
- **Spreadsheets:** For organizing and analyzing data.
- **Web browsers:** For accessing and viewing web pages.
- **Games:** For entertainment.

4. Difference between disassembling and assembling computer

Assembling a computer refers to the process of putting together various hardware components to create a functional system. This typically involves selecting and connecting parts such as the motherboard, CPU, RAM, storage drives, power supply, and peripherals like the monitor and keyboard. The goal is to ensure that all components work together seamlessly to perform tasks.

On the other hand, disassembling a computer is the process of taking apart an existing system. This might be done for maintenance, repairs, upgrades, or recycling purposes. Disassembling involves carefully removing components,

ensuring that they are not damaged in the process, and often requires knowledge of how the parts fit together to avoid any mishaps.

Practical Activity 1.4.2: Disassembling a computer system

Task:

1: Read the key reading 1.4.2
2: Referring to the key reading 1.4.2 you are requested to disassemble computer system.
3: Present your work to the trainer and whole class.
4: In addition, ask questions where necessary.

Key readings 1.4.2: Disassembling a computer system

- **Steps for Disassembling a Computer System**

Note: Before disassembling your computer, ensure you have a clear workspace and follow safety guidelines.

1. **Power Off and Disconnect:**

Unplug: Turn off your computer and disconnect it from the power outlet.

Remove Peripherals: Disconnect all external devices like monitors, keyboards, and mice.

2. **Open the Case:**

Locate the Case Screws: These are usually found on the back or sides of the case.

Remove Screws: Carefully unscrew the case panels, starting with the side panel that houses the motherboard.

3. **Disconnect Components:**

Power Supply: Disconnect the power supply cables from the motherboard, hard drives, and optical drives.

Storage Devices: Remove any data cables (SATA or IDE) from hard drives and optical drives.

Motherboard Components: Disconnect any cables or wires attached to the motherboard, such as USB, audio, and network cables.

4. **Remove Motherboard:**

Release the Standoffs: Unscrew any standoffs holding the motherboard in place.
Lift Carefully: Gently lift the motherboard and remove it from the case.
5. **Remove Other Components:**
CPU Cooler: If applicable, remove the CPU cooler by detaching its mounting clips or screws.
CPU: Carefully remove the CPU from the motherboard.
Expansion Cards: Remove any expansion cards (like graphics cards or sound cards) from their PCIe slots.
6. **Remove Additional Components:**
Fans: Remove any case fans or power supply fans.
Front Panel Connectors: Disconnect any cables connected to the front panel of the case (e.g., power button, USB ports).

Points to Remember

- There are some types of computers: Personal Computers (PCs), Workstations, Servers, Mainframes, Supercomputers
- Computers are classified into different categories based on various factors such as: Based on Size and Processing Power, based on Purpose, Based on Function
- Assembling and disassembling a computer are two opposite processes involved in handling computer hardware, where assembling a computer involves putting together various components to create a functional computer system, while disassembling a computer is the process of taking a computer apart, which might be done for various reasons, such as repairs, upgrades, or recycling.
- **Steps for Disassembling a Computer System**

1. Power Off and Disconnect
2. Open the Case
3. Disconnect Components
4. Remove Motherboard
5. Remove Other Components
6. Remove Additional Components

Application of learning outcome 1.4

You are a technician at XYZ Company, and you have been assigned the task of disassembling a computer system, you are tasked to disassemble the computer carefully, ensuring that all components are handled safely and stored properly for future reassembly or replacement.

Indicative content 1.5: Installation of New Hardware Component

Duration: 3 hrs

Practical Activity 1.5.1: Installing a New Hardware Component

Task:

1: Read the key reading 1.5.2
2: Referring to the key reading 1.5.2 you are requested to install new hardware.
3: Present your work to the trainer and whole class.
4: In addition, ask questions where necessary.
5: Perform the activity in the application of learning 1.5

Key readings 1.5.1: installing new hardware in a computer:

Here are the general steps for installing new hardware in a computer:

1. **Identification of the new hardware component**

A.CPU (Central Processing Unit):

Identification: Usually, a square or rectangular chip located in the motherboard's CPU socket. It may have a protective cover.

Installation: Align the notches on the CPU with the socket, lift the lever, place the CPU in gently, and secure it.

B.RAM (Random Access Memory):

Identification: Long, narrow sticks typically located in slots on the motherboard, often with clips on either end.

Installation: Open the clips, align the notch on the RAM with the slot, and press down firmly until the clips snap back into place.

C. GPU (Graphics Processing Unit):

Identification: A larger card that slots into the PCIe (Peripheral Component Interconnect Express) slot on the motherboard, often with one or more fans.

Installation: Remove the appropriate expansion slot cover on the case, align the GPU with the PCIe slot, and press down until it clicks into place. Secure it with screws if necessary.

D. Storage Drives (HDD/SSD):

Identification: Hard disk drives (HDDs) are larger, while solid-state drives (SSDs) can be 2.5-inch drives or M.2 form factors (a small stick).

Installation: For 2.5-inch drives, secure them in a drive bay using screws. For M.2 drives, align it with the M.2 slot on the motherboard, insert at an angle, and secure it with a screw.

E. Motherboard:

I**dentification**: The main circuit board that houses the CPU, RAM, and expansion slots. It has various ports and connectors.

Installation: Place the motherboard in the case, aligning it with standoffs, and secure it with screws.

F. Power Supply Unit (PSU):

Identification: A rectangular box typically located at the bottom or top of the case. It has multiple cables for power connections.

Installation: Secure the PSU in its designated area, usually with screws, and connect the appropriate cables to the motherboard, CPU, and other components.

G. Cooling Solutions (Fans/Heatsinks):

Identification: Fans are typically circular, while heatsinks are metal blocks with fins.

Installation: For CPU coolers, apply thermal paste, if necessary, align the cooler with the CPU, and secure it according to the manufacturer's instructions. Attach case fans to the appropriate mounting points.

H. Case:

Identification: The outer shell that houses all components. It has various ports and drive bays.

Installation: Ensure all components fit within the case, and secure them using screws or clips.

I. Peripheral Devices:

Identification: Devices like keyboards, mice, monitors, and printers that connect externally.

Installation: Connect using USB, HDMI, or other relevant ports.

J. Cables and Connectors:

Identification: Various cables, including SATA cables for storage, power cables from the PSU, and data cables.

Installation: Connect each cable to the appropriate ports, ensuring they are securely plugged in.

2.Check hardware component Compatibility

A. Check the Motherboard Specifications:

CPU Compatibility: Verify that the CPU you want to install is compatible with your motherboard's socket type. Check the motherboard's documentation or manufacturer's website for a CPU compatibility list.

RAM Compatibility: Check the type (DDR4, DDR5, etc.) and maximum capacity of RAM supported by the motherboard. Also, confirm the maximum number of RAM slots available.

Expansion Slots: Ensure that the motherboard has the necessary PCIe slots for your GPU and any other expansion cards you plan to install.

B. Verify Power Supply Requirements:

Wattage: Ensure that your power supply unit (PSU) has enough wattage to support all components, especially the CPU and GPU. Use online PSU calculators to estimate the total wattage needed.

Connectors: Check that the PSU has the required connectors for your motherboard (24-pin ATX, 4/8-pin CPU power) and GPU (6-pin, 8-pin, etc.).

C. Storage Compatibility:

Interface Type: Confirm that your motherboard supports the type of storage drives you plan to use (SATA, M.2 NVMe, etc.). Check the number of available SATA ports if using traditional HDDs or SSDs.

Form Factor: Ensure that your case has enough space for the storage drives you want to install, especially for larger HDDs or multiple SSDs.

D. Graphics Card (GPU) Compatibility:

Physical Space: Ensure that your case has enough physical space for the GPU. Check the GPU length and compare it with the available space in your case.

PCIe Slot: Confirm that your motherboard has a compatible PCIe x16 slot available for the GPU.

E. Cooling Solutions:

CPU Cooler Compatibility: Check that the CPU cooler is compatible with your CPU socket and fits within your case. Verify the height of the cooler if you have a compact case.

Case Fans: Ensure that your case has enough fan mounting points and that the fans are compatible with the case (size and connector type)

F. Case Compatibility:

Motherboard Form Factor: Ensure that the case supports the motherboard size (ATX, microATX, mini-ITX).

Cooling and Airflow: Check that the case allows for adequate airflow and has space for additional cooling solutions if needed.

3.Implementation of new hardware installation procedures

A. **Open the Computer Case**

Use a screwdriver to remove the side panel of the case to access the internal components.

B. **Locate the Hardware Slot or Space**

Identify the correct slot or area for the hardware (e.g., PCIe slot for a GPU, RAM slots, M.2 for an SSD).

C. **Install the Hardware**

Gently align and insert the new hardware into the appropriate slot or connection point. Ensure it is seated properly and secure it with screws if needed.

D. **Connect Necessary Cables**

Attach any required power or data cables (e.g., connecting the PSU to the GPU or storage device to the motherboard).

E. **Close the Case**

Reattach the side panel of the case and screw it back into place.

F. **Power On the computer**

Plug the computer back in, power it on, and enter the BIOS/UEFI to ensure the new hardware is recognized.

G. **Install Drivers (if needed)**

Once in the operating system, install any necessary drivers or software to ensure the hardware functions correctly.

H. **Test the Hardware**

- Run tests to verify that the new hardware is working properly (e.g., benchmarks for GPUs, performance checks for storage devices).

Points to Remember

- **While installing a new hardware component pass through the following steps:**

1. Turn Off and Unplug the Computer
2. Open the Computer Case
3. Locate the Hardware Slot or Space
4. Install the Hardware
5. Connect Necessary Cables
6. Close the Case
7. Power On
8. Install Drivers (if needed)
9. Test the Hardware

Application of learning 1.5.

ABC Company hired you as a computer technician and you are tasked with refurbishing an aging desktop computer system. The goal is to install the new hardware to improve performance and extend its lifespan.

Indicative content 1.6: Assembling Computer System

Duration: 3hrs

Practical Activity 1.6.1: Assembling Computer System

Task:

1: Read the key reading 1.6.1
2: Referring to the key reading 1.6.1 you are requested to assemble computer system.
3: Present your work to the trainer and whole class.
4: In addition, ask questions where necessary.
5: Perform the activity in the application of learning 1.6

Key readings 1.6.1: Assembling Computer System

Steps of assembling Computer system

1. **Gather Your Tools and Components:**

   Tools Needed: A Phillips-head screwdriver, anti-static wrist strap (optional but recommended), and cable ties for organization.

   Components Needed: CPU, RAM, motherboard, power supply unit (PSU), storage drives (HDD/SSD), graphics card (if applicable), case, and cooling solutions.

2. **Prepare Your Workspace:**

✓ Choose a clean, flat surface with good lighting.
✓ Ensure you have enough space to lay out all components and tools.

3. **Install the Power Supply Unit (PSU)**

✓ Open the computer case.
✓ Insert the PSU into the designated space in the case and secure it with screws.
✓ Ensure the PSU cables are accessible for later connections.

4. **Install the Motherboard**

✓ Install standoffs in the case to prevent the motherboard from touching the case.
✓ Carefully place the motherboard in the case, aligning it with the I/O shield and screw holes.
✓ Secure the motherboard with screws.

5. **Install the Central Processing Unit (CPU)**

✓ Open the CPU socket on the motherboard.
✓ Align the CPU with the socket (match the corner markers) and gently place it in the socket.
✓ Close the socket lever to secure the CPU.

6. **Install CPU Cooler**

- ✓ Apply a small amount of thermal paste to the CPU if needed.
- ✓ Attach the CPU cooler, following the manufacturer's instructions.
- ✓ Connect the cooler's fan to the motherboard (typically to the CPU_FAN header).

7. **Install Memory (RAM**)

- ✓ Locate the RAM slots on the motherboard.
- ✓ Align the RAM sticks with the slots and press them in until the latches click into place.

8. Install Storage (SSD/HDD)

- ✓ If using an M.2 SSD, insert it into the M.2 slot on the motherboard and secure it.
- ✓ For 2.5" or 3.5" drives (SSD/HDD), place them in the drive bays and secure them with screws.
- ✓ Connect the storage device to the motherboard using SATA cables (if required).

9. Install the Graphics Card (GPU)

- ✓ Insert the GPU into the PCIe slot on the motherboard.
- ✓ Secure the GPU to the case using screws.
- ✓ Connect power cables from the PSU to the GPU (if necessary).

10. Connect Power and Data Cables

- ✓ Connect the 24-pin ATX power connector from the PSU to the motherboard.
- ✓ Connect the 8-pin CPU power cable to the motherboard.
- ✓ Connect SATA power and data cables to storage drives.
- ✓ Connect front panel cables (power button, USB, audio, etc.) to the motherboard.

11. Test the System

- ✓ Plug the system into power and connect a monitor, keyboard, and mouse.
- ✓ Power on the system and check if it boots into BIOS/UEFI.

II. While customizing appearance of a computer system Perform following:

Performing appearance customization on a computer system can enhance your user experience and make your workspace more visually appealing.

Here's a step-by-step guide to help you customize the appearance of your computer, focusing on both hardware and software aspects:

1. **Customize the Desktop Background:**

   Windows: Right-click on the desktop and select "Personalize." Choose "Background" and select an image or slideshow from your files or the built-in options.

2. **Change the Theme:**

   Windows: In the "Personalization" menu, select "Themes" to choose a pre-installed theme or create your own by customizing colors, sounds, and backgrounds.

3. **Customize Taskbar and Dock:**

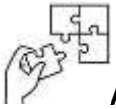
   Windows: Right-click on the taskbar to access settings. You can lock the taskbar, change its position, and customize which icons appear.

4. **Adjust Icon Appearance**:
   Windows: Right-click on the desktop, select "View," and choose icon size (small, medium, large). You can also change individual icon properties by right-clicking on them.
5. **Change Font Styles and Sizes:**
   Windows: Go to "Settings" > "Ease of Access" > "Display" to adjust text size. For more advanced font customization, you might need third-party software.
6. **Customize Folder Icons:**
   Windows: Right-click on a folder, select "Properties," then go to the "Customize" tab to change the folder icon.
7. **Install and Use Custom Themes**:
   Windows: Explore third-party websites for custom themes. Use tools like "UltraUXThemePatcher" to enable third-party themes but proceed with caution.

Points to Remember

- **While assembling a computer system pass through the following steps:**

1. Install the Power Supply Unit (PSU)
2. Install the Motherboard
3. Install the Central Processing Unit (CPU)
4. Install CPU Cooler
5. Install Memory (RAM)
6. Install Storage (SSD/HDD)
7. Install the Graphics Card (GPU)
8. Connect Power and Data Cables
9. Test the System



Application of learning 1.6.

A small business owner has recently purchased a new computer component. The owner has attempted to assemble the computer system themselves but has encountered difficulties. You are requested to assemble and customize computer system.

Indicative content 1.7: Installation of Computer System Drivers and Software

Duration: 3 hrs

Theoretical Activity 1.7.1: Description of computer system drivers and software

Tasks:

1: Answer the following questions related to the software:

I. What are the criteria to consider while checking software compatibility?

II. Define device drivers

2: Provide the answer for the asked questions and write them on papers.

3: Present the findings/answers to the whole class

4: For more clarification, read the key readings 1.7.1. In addition, ask questions where necessary.

Key readings 1.7.1.: Description of computer system drivers and software

Software compatibility checking

1. **Criteria for Choosing Compatible Software**

When selecting software for your computer system, compatibility is a crucial factor to consider.

Here are some key criteria to evaluate:

1.1 Operating System Compatibility:

OS Version: Ensure the software is compatible with your specific operating system (e.g., Windows 11, macOS Monterey, Ubuntu 22.04).

Bit Depth: Check if the software is 32-bit or 64-bit compatible to match your system's architecture.

1.2 Hardware Requirements:

Processor: Verify that your processor meets the minimum and recommended requirements.

RAM: Ensure you have sufficient RAM to run the software smoothly.

Storage: Check if your storage space is adequate for the software installation and its data.

Graphics Card: If the software is graphics-intensive, ensure your graphics card meets the requirements.

1.3 Software Dependencies:

Libraries and Frameworks: Some software may require additional libraries or frameworks to function correctly.

Compatibility Checks: Verify that these dependencies are installed and compatible with your system.

1.4 Feature Set:

Functionality: Assess if the software offers the features and capabilities you need.

Customization: Consider if the software can be customized to your specific requirements.

1.5 User Interface:

Ease of Use: Evaluate the software's user interface and how intuitive it is to navigate.

Compatibility with Your Workflow: Consider if the software's interface and features align with your preferred workflow.

1.6 Support and Updates:

Customer Support: Assess the availability and quality of the software developer's customer support.

Updates: Check if the software receives regular updates and patches to address bugs and security vulnerabilities.

2. **Drivers**

Drivers are a specific type of software that allow the operating system and other programs to communicate with hardware devices. Each hardware component (like a printer, graphics card, or network adapter) requires a driver to function properly. Drivers translate high-level commands from the operating system into device-specific operations, making the hardware usable by the system.

Drivers are essential software components in a computer system that allow the operating system (OS) to communicate with hardware devices. They act as intermediaries between the OS and the hardware, translating commands and data so that both can understand each other. Here's a detailed overview of drivers and their importance:

2.1. Purpose of Drivers:

Communication: Drivers enable the operating system to send and receive data to and from hardware devices, such as printers, graphics cards, sound cards, and storage devices.

Functionality: They provide the necessary instructions for the OS to utilize the features and functions of the hardware effectively.

Control: Drivers allow users and applications to control hardware devices through the OS.

2.2. Types of Drivers:

Device Drivers: These are the most common type, designed for specific hardware components. Examples include:

Graphics Drivers: Enable the OS to communicate with the graphics card, affecting display settings and performance.

Printer Drivers: Allow the OS to send print jobs to the printer and manage printing settings.

Audio Drivers: Enable sound output and control audio settings for sound cards or integrated audio devices.

Kernel Drivers: These operate at the kernel level and manage hardware directly, such as disk drivers for hard drives and SSDs.

Virtual Device Drivers: Used for virtual devices, such as virtual printers or virtual network adapters, often found in virtualization software.

2.3. Importance of Drivers:

Performance: Proper drivers ensure that hardware operates efficiently and at its intended performance level.

Compatibility: Drivers ensure that the hardware is compatible with the OS and other software applications.

Functionality: Without the correct drivers, hardware devices may not work at all or may have limited functionality.

Practical Activity 1.7.2: Installing computer system software

Task:

1: Read the key reading 1.7.2

2: Referring to the key reading 1.7.2 you are requested to install new software in the computer

3: Present your work to the trainer and whole class.

4: In addition, ask questions where necessary.

Key readings 1.7.2: Installing computer system software

- **Software Installation Procedures**

  Here are the general steps involved in installing software on a computer:

✓ **Download the Software**:

Locate the software you want to install. This could be from the software developer's website, an app store, or a third-party distribution platform.

Download the installation file (usually an .exe, .dmg, or .deb file).

✓ **Run the Setup File:**

Double-click the downloaded installation file to launch the setup wizard.

Follow the Instructions:

The setup wizard will guide you through the installation process.

You may be asked to agree to terms and conditions, choose an installation location, and select features to install.

- ✓ **Installation Progress:**
  The installer will extract and copy the necessary files to your computer. This may take some time, depending on the size of the software.
- ✓ **Complete Installation**:
  Once the installation is complete, you'll usually be prompted to restart your computer for the changes to take effect.

- **Install system software:**
  Installing system software typically involves several steps, which can vary depending on the type of operating system you are installing (like Windows, macOS, or Linux).
  Here's a general outline of the steps you might follow:

  1. **Prepare Your System**: Ensure your hardware meets the minimum requirements for the system software. Backup any important data to avoid loss during installation.
  2. **Obtain the Software**: Download the system software from the official website or use installation media like a USB drive or DVD.
  3. **Create Installation Media (if necessary):** If you're using a USB drive, you may need to create a bootable USB drive using tools like Rufus or the built-in tools in your operating system.
  4. **Boot from Installation Media:** Insert the installation media into your computer and restart it. You may need to enter the BIOS/UEFI settings to change the boot order to prioritize the installation media.
  5. **Start the Installation Process:** Once your computer boots from the installation media, follow the on-screen prompts to start the installation.
  6. **Select Installation Type:** You may be given options such as a clean installation or an upgrade. Choose the one that suits your needs.
  7. **Partitioning:** If you're doing a clean install, you may need to partition your hard drive. This step allows you to allocate space for the new operating system.
  8. **Follow On-Screen Instructions:** Continue with the installation by following the prompts, which may include selecting your language, time zone, and keyboard layout.
  9. **Enter Product Key:** If required, enter your product key to activate the software.
  10. **Configure Settings:** After installation, you may need to configure user accounts, network settings, and privacy options.

11. **Install Updates and Drivers:** Once the installation is complete, check for any updates and install necessary drivers for your hardware.

12. **Restore Data:** If you backed up data, you can now restore it to your new system.

13. **Final Checks:** Ensure everything is working properly and customize your settings as needed.

- **Installing Application Software:**

  Installing application software typically involves a few straightforward steps. Here's a general guide:

  1. Check System Requirements: Before you begin, ensure that your device meets the minimum system requirements for the software.

  2. Download the Software: If you're installing from the internet, visit the official website or a trusted source to download the installation file. If you have a physical copy, insert the CD/DVD or connect the USB drive.

  3. Run the Installer: Locate the downloaded file (usually in your Downloads folder) or access the physical media. Double-click the installation file to start the installation process.

  4. Follow the Installation Wizard: Most applications will launch an installation wizard. Follow the on-screen instructions, which may include accepting terms of service, choosing an installation location, and selecting components to install.

  5. Configure Settings: Some applications may allow you to customize settings during installation. Adjust these according to your preferences.

  6. Complete the Installation: Once you've followed all the prompts, the installation process will begin. This may take a few minutes. When it's finished, you'll usually see a confirmation message.

  7. Launch the Application: After installation, you can typically find the application in your Start Menu (Windows) or Applications folder (Mac). Click to launch it.

  8. Update the Software: After installation, check for any available updates to ensure you have the latest features and security patches.

  9. Register or Activate: If the software requires a license key or registration, follow the prompts to activate it

Points to Remember

- When selecting software for your computer system, compatibility is a crucial factor to consider. Here are some key criteria to evaluate which are: Operating System Compatibility, Hardware Requirements, Software Dependencies, Feature Set, User Interface, Support and Updates
- **A device driver** is a type of software that allows a computer's operating system to communicate with a specific hardware device.
- **Here are the general steps involved in installing software on a computer:**
  1. Select the type of software to be installed.
  2. Download the Software /having installer setup.
  3. Run the Setup File
  4. Follow the Instructions
  5. Installation Progress
  6. Complete Installation

Application of learning 1.7.

Mid-sized company, has just on boarded new employees. They need to install a new software and install device drivers in their computers to complete daily tasks. However, they are not familiar with the installation process. You are asked to install both system software and application software.

Indicative content 1.8: Perform Computer System Test

Duration: 1 hr

Theoretical Activity 1.8.1: Description of computer system testing

Tasks:

1: Answer the following questions

i. Provide clear description about:
   a. System functionality
   b. System performance
   c. System stress test

2: Provide the answers for the asked questions and write them on flipchart/papers.

3: Present the findings/answers to the whole class.

4: Ask questions for more clarification if necessary.

5: For more clarification, read the key readings 1.8.1.

Key readings 1.8.1.: Description of computer system test

1.System Functionality Testing

This involves verifying that all components and features of the system are working as intended. It ensures that the system can perform its basic functions accurately and without errors. Key aspects of functionality testing include:

- **UI Testing:** Checking the user interface for responsiveness, intuitiveness, and correct behavior.
- **Feature Testing:** Verifying that each individual feature or function works as expected.
- **Data Validation:** Ensuring that the system can handle valid and invalid data inputs appropriately.
- **Integration Testing:** Testing how different components or modules interact with each other.

2.System Performance Testing

This focuses on evaluating the system's performance under various conditions, including load, stress, and peak usage. It helps identify bottlenecks and areas for optimization. Performance testing includes:

- **Load Testing:** Simulating increasing user loads to assess how the system handles peak usage.
- **Stress Testing:** Pushing the system to its limits to identify its breaking point and evaluate its stability.

- **Benchmarking:** Comparing the system's performance against industry standards or benchmarks.

3.System Stress Testing

This is a more intensive form of performance testing that involves subjecting the system to extreme conditions to identify its limitations and vulnerabilities. Stress testing can include:

- **CPU Stress:** Pushing the CPU to its maximum capacity to evaluate its ability to handle heavy workloads.
- **Memory Stress:** Overloading the system's memory to assess its responsiveness and stability.
- **Disk I/O Stress:** Simulating heavy read/write operations to evaluate the disk subsystem's performance.
- **Network Stress:** Flooding the network with excessive data to evaluate its bandwidth and latency.

Practical Activity 1.8.2: Perform computer system testing

Task:

1: Read the key reading 1.8.2
2: Referring to the key reading 1.8.2 you are requested to go to the computer Lab to perform computer system testing.
3: Present your work to the trainer and whole class.
4: In addition, ask questions where necessary.

Key readings 1.8.2: Perform computer system testing.

Here are general steps for performing system testing

1.Planning the Testing Process

Define Objectives: Determine what you want to achieve with the testing (e.g., validate functionality, performance, security).

Identify Scope: Define which parts of the system will be tested and which will not.

Select Testing Methods: Choose appropriate testing methodologies (e.g., manual testing, automated testing).

2. Gathering Requirements

Collect Documentation: Gather all relevant documentation, including requirements specifications, design documents, and user manuals.

Understand User Needs: Ensure you have a clear understanding of user expectations and system requirements.

3. Designing Test Cases

Create Test Scenarios: Develop high-level scenarios that reflect user interactions with the system.

Write Detailed Test Cases: For each scenario, create detailed test cases that specify inputs, execution steps, expected results, and actual results.

Prioritize Test Cases: Rank test cases based on criticality and risk to focus on the most important areas first.

4. Setting Up the Test Environment

Prepare the Environment: Set up hardware, software, and network configurations needed for testing.

Install the System: Ensure the application or system is correctly installed and configured in the test environment.

5.Executing Test Cases

Run Tests: Execute the test cases according to the defined steps.

Document Results: Record the outcomes of each test, noting any discrepancies between expected and actual results.

6.Reporting Defects

Log Issues: If any defects or issues are found, document them in a defect tracking system with detailed information for developers.

Prioritize Defects: Classify defects based on severity and impact on the system.

7. Retesting and Regression Testing

Fix Defects: Work with the development team to resolve any identified issues.

Retest: Once defects are fixed, retest to ensure that the issues have been resolved.

Perform Regression Testing: Check that new changes have not adversely affected existing functionality.

8. Performance Testing

Conduct Performance Tests: Evaluate the system's performance under various conditions, including load testing, stress testing, and soak testing.

Analyze Performance Metrics: Review performance data to identify any bottlenecks or areas for improvement.

9. User Acceptance Testing (UAT)

Involve End Users: Allow end users to test the system in a real-world scenario to confirm it meets their needs.

Gather Feedback: Collect feedback from users and make any necessary adjustments.

10. Final Review and Reporting

Compile Test Results: Summarize the results of all testing activities, including successful tests and outstanding issues.

Prepare Test Summary Report: Create a report that outlines the testing process, findings, and recommendations for further action.

11. Closure

Review and Sign Off: Conduct a final review with stakeholders to ensure satisfaction with the testing process and results.

Document Lessons Learned: Note any insights gained during testing for future projects.

Performing a comprehensive computer system test involves evaluating various aspects of the system, including functionality, performance, and stress testing.

Here's a breakdown steps of how you can conduct each type of test:

1. System Functionality Testing

Objective: To ensure that all features and functions of the system work as intended.

Steps:

Identify Requirements: Gather all functional requirements and specifications of the system.

Create Test Cases: Develop test cases that cover all functionalities, such as user login, data entry, report generation, and any other critical features.

Execute Test Cases: Run the test cases and document the outcomes. Verify that each function behaves as expected.

Record Results: Note any discrepancies or bugs found during testing and categorize them based on severity.

Retesting: After bugs are fixed, retest to ensure that the issues are resolved.

2. System Performance Testing

Objective: To evaluate the system's responsiveness, speed, and overall performance under normal conditions.

Steps:

Define Performance Criteria: Establish benchmarks for acceptable performance, such as response times, throughput, and resource usage.

Select Testing Tools: Use tools like Apache JMeter, LoadRunner, or like simulate user interactions.

Conduct Tests: Run tests under normal load conditions to measure performance metrics. This may include:

Response Time: Time taken to complete requests.

Throughput: Number of transactions processed in a given time.

Resource Utilization: Monitor CPU, memory, and network usage during operation.

Analyze Results: Compare the metrics against the defined criteria to determine if the system meets performance expectations.

3. System Stress Testing

Objective: To determine how the system behaves under extreme conditions and identify its breaking point.

Steps:

Define Stress Levels: Establish what constitutes a stress level for the system (e.g., double the expected maximum load).

Use Stress Testing Tools: Implement tools like Apache JMeter or LoadRunner to simulate high load scenarios.

Execute Stress Tests: Gradually increase the load until the system reaches its limits. This can include:

Load Testing: Gradually increase user load.

Spike Testing: Sudden increase in load to test immediate response.

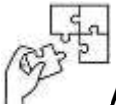
Soak Testing: Run at high load for an extended period to check for memory leaks or performance degradation.

Monitor System Behavior: Observe how the system responds, including error rates, response times, and resource utilization.

Document Findings: Record the results, noting the point of failure and any performance degradation observed.

Points to Remember

- System Functionality Testing involves verifying that all components and features of the system are working as intended. It ensures that the system can perform its basic functions accurately and without errors.
- System Performance Testing focuses on evaluating the system's performance under various conditions, including load, stress, and peak usage. It helps identify bottlenecks and areas for optimization.
- System Stress Testing is a more intensive form of performance testing that involves subjecting the system to extreme conditions to identify its limitations and vulnerabilities.
- **Best Practices for Computer System Testing**
    1. Planning the Testing Process
    2. Gathering Requirements
    3. Designing Test Cases
    4. Setting up the Test Environment
    5. Executing Test Cases
    6. Reporting Defects
    7. Performance Testing
    8. User Acceptance Testing (UAT)
    9. Final Review and Reporting



Application of learning 1.8

A company is refurbishing a batch of used computers for resale. The computers have undergone hardware repairs, cleaning, and software reinstallations. Before offering the refurbished systems to customers, they need to conduct thorough testing to ensure their reliability and functionality, as technician you are requested to test the computer system.

Learning outcome 1 end assessment

Written assessment

I. Circle the letter that corresponds to the correct answer.

1. A workplace in computer refurbishment typically refers to:
    a) A facility where computers are manufactured.
    b) A place where people work on their personal computers.
    c) A place where used or damaged computers are repaired and resold.
    d) A facility where computer parts are sold.
2. PPE is primarily used to:
    e) Protect employees from workplace hazards.
    a) Enhance computer performance.
    b) Improve employee productivity.
    c) Make the workplace more aesthetically pleasing.
3. The main goal of ergonomic design in ICT is to:
    a) Create a visually appealing workplace.
    b) Increase computer speed.
    c) Reduce the risk of discomfort and injury for users.
    d) Make computers more expensive.
4. Safety in a computer workplace refers to:
    a) Preventing accidents and injuries.
    b) Ensuring computers are always working.
    c) Making the workplace more comfortable.
    d) Increasing computer sales.
5. Proper waste disposal in a computer workplace helps to:
    a) Prevent accidents.
    b) Improve computer performance.
    c) Reduce the risk of attracting pests.
    d) Make the workplace more colourful.
6. Which of the following is considered as the brain of the computer?
    a) Motherboard
    b) RAM
    c) CPU
    d) BIOS chip
7. A device that allows entering data and instruction into a computer system is called
    a) Interaction
    b) Terminal
    c) Communication

d) Input

8. Which of the following are not input devices?
    a) Keyboard, trackball, light pen
    b) Barcode reader, OMR, OCR, MICR
    c) Biometric sensor, scanner, Mic
    d) Plotter, projector, headphones
9. Microsoft Word, Microsoft Excel, and Google Docs are the examples of
    a) An operating software
    b) System software
    c) Utility software
    d) Application software

II. TRUE OR FALSE QUESTIONS:

1. Computer hardware refers to the intangible components of a computer system.
2. Software is considered a type of hardware
3. System software helps run applications.
4. Word processing and games are examples of system software.
5. The CPU is often referred to as the "brain" of the computer.
6. Expansion cards can be used to add features like sound or networking capabilities.
9. A keyboard is an output device.
10. A webcam is used to capture video input.
11. A printer is an input device.
12. Speakers are used to output audio signals.
13. It is not safe to disassemble a computer while it is still plugged into the power source.
14. Static electricity can damage internal components of a computer, such as the RAM or motherboard.
15. It is not okay to skip installing thermal paste between the CPU and the heatsink, as it is essential for proper cooling.
16. It is important to update drivers after installing new hardware in a computer.
17. Cleaning dust from computer components can improve the overall performance of the system.

Practical assessment

XYZ is a refurbishing company wants to perform computer system renovation to their computers to improve performance, enhance security and ensure compatibility with modern software and hardware to their computer system. The renovation will involve Setting Working Place, Selection of Computer system components, Selection of Tools, materials and equipment, Disassembling Computer system, Installation of New hardware component, Assembling Computer system, Installation of Computer system drivers and software, Perform computer system test.

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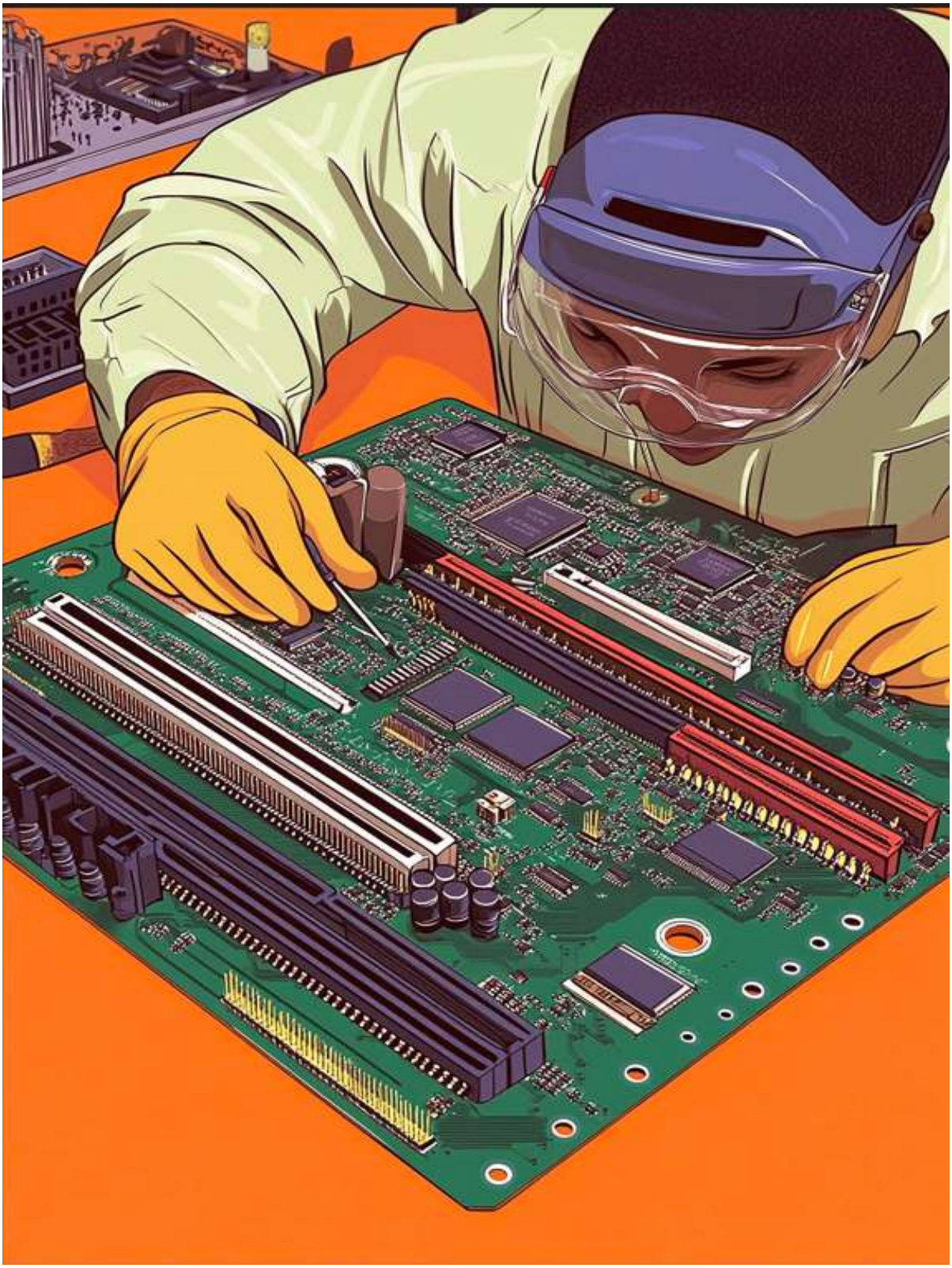


Indicative Contents
2.1 Perform Computer System Motherboard Troubleshooting
2.2 Perform Computer System Software Troubleshooting
2.3 Perform Computer System Testing

Key Competencies for Learning Outcome 2: Perform Computer System Restoration

Knowledge	Skills	Attitudes
• Description computer system motherboard • Identification the common faults of motherboard. • Description of computer system testing	• Assembling computer system motherboard • Performing repair computer system motherboard • Performing computer system software troubleshooting • Performing computer system testing	• Being Innovative • Having organization • Having safety First • Having flexibility • Having time Management • Being Problem Solving • Being Self-motivated • Being Detail-oriented

Duration: 30hrs

Learning outcome 2 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe correctly computer system motherboard based on computer system functionality
2. Describe correctly common faults of motherboard based on computer system functionality
3. Identify appropriately faults of motherboard based on computer system functionality
4. Perform correctly repair computer system motherboard according to the faults of motherboard
5. Test appropriately computer system motherboard component based on computer system functionality
6. Assemble correctly computer system motherboard based on computer system functionality
7. Perform correctly Computer system software troubleshooting based on computer system functionality
8. Perform correctly computer system testing based on computer system functionality

Resources

Equipment	Tools	Materials
• Power supply tester • Multi-meter • Anti-static mat • SMD rework station • Blower	• Tweezers • Screwdrivers • Soldering iron • Desoldering pump • Flashlight or headlamp • Needle-nose pliers • Wire cutter/striper	• Anti-static wrist strap/mat • Thermal paste • Isopropyl alcohol and cotton swabs • Soldering wire (tin) • Labelling materials • Spare screws • Soldering paste • Electrical tape and zip ties

		• Desoldering wick

Indicative content 2.1: Perform Computer System Motherboard Troubleshooting

Duration:15 hrs

Theoretical Activity 2.1.1: Description of computer system motherboard

Tasks:

1: Discuss and answer the following questions:

I. Define computer system motherboard
II. Explain the Main components of computer system motherboard and their function
III. State Interconnections and Communication of computer system on the motherboard components
IV. What are computer system motherboard technologies

2: Present your findings to the trainer and your colleagues

3: Ask clarifying questions whenever necessary.

4: Read key readings 2.1.1 in trainee's manual

Key readings 2.1.1: Description of computer system motherboard

1. Definition of computer system motherboard

A motherboard is the primary printed circuit board (PCB) in a computer system. It serves as the central hub that connects and enables communication between all the crucial electronic components of the system.

2. **Main components of computer system motherboard and their function**

The motherboard is the central circuit board of a computer, connecting and powering various components. Here are its key components and their functions:

1. Processor Socket:

- **Function:** Holds the central processing unit (CPU), the brain of the computer.
- **Purpose:** Allows the CPU to communicate with the rest of the system.

2. Memory Slots:

- **Function:** Accommodates random access memory (RAM), which stores data and instructions for the CPU.
- **Purpose:** Enables the CPU to access data quickly and efficiently.

3. Expansion Slots:

- **Function:** Provides connections for expansion cards, such as graphics cards, sound cards, and network interfaces.
- **Purpose:** Allows for customization and expansion of the computer's capabilities.

4. Chipset:

- **Function:** A set of integrated circuits that manages communication between the CPU, RAM, and other components.
- **Purpose:** Ensures smooth operation and data transfer within the system.

5. Southbridge:

- **Function:** A part of the chipset that handles communication with slower devices like storage drives and I/O ports.
- **Purpose:** Facilitates data transfer and control of peripheral devices.

6. BIOS (Basic Input/ Output System):

- **Function:** Firmware that controls the basic operations of the computer when it's first powered on.
- **Purpose:** Initializes hardware components, loads the operating system, and provides essential system information.

7. Power Supply Connector:

- **Function:** Connects to the power supply unit to provide electricity to the motherboard and its components.
- **Purpose:** Ensures the system has sufficient power to operate.

8. I/O Ports:

- **Function:** Provides connections for external devices like keyboards, mice, monitors, and USB devices.
- **Purpose:** Enables communication and interaction with the computer's peripherals.

9.CMOS Battery: This small, button-like battery powers the CMOS (Complementary Metal-Oxide-Semiconductor) memory, which stores BIOS settings, date, and time even when the computer is powered off.

10.Power Connectors: These connectors link the motherboard to the computer's power supply unit, providing power to all components on the motherboard.

11.Heat Sinks and Cooling Solutions: Many motherboards include heat sinks and fan headers to dissipate heat generated by the CPU, chipset, and other components

12. **Connectors for Storage Devices:** Motherboards include connectors for various storage devices, such as SATA ports for hard drives and SSDs.

3.Interconnections and Communication of computer system motherboard components

Interconnections and communication between the various components on a computer system motherboard are crucial for the proper functioning of the computer. These components communicate through a combination of electrical and data pathways. Here's how different motherboard components interconnect and communicate:

1. **CPU to RAM:** The CPU communicates with the RAM through the memory controller. The CPU reads and writes data to RAM for temporary storage and quick access. The memory controller manages data flow between the CPU and RAM.
2. **CPU to Chipset:** The CPU communicates with the chipset through a high-speed connection. The chipset, particularly the Northbridge, facilitates communication between the CPU and other high-speed components like RAM and graphics cards.
3. **Chipset to RAM:** The chipset, specifically the Northbridge, manages the data flow between the CPU and RAM. It controls data access and transfer rates to ensure smooth operation.
4. **Chipset to Southbridge:** The Southbridge communicates with the Northbridge to manage data transfer between lower-speed components, such as USB ports, SATA connectors, audio, and networking.
5. **Expansion Slots to CPU and Chipset:** Components installed in expansion slots (e.g., graphics cards, sound cards) communicate with the CPU or chipset depending on the slot type (e.g., PCIe). These components may have their own processors and memory.
6. **Storage Devices (SATA, M.2) to Chipset:** Storage devices like hard drives and SSDs connect to the motherboard via SATA connectors or M.2 slots. The chipset, through the Southbridge, manages data transfer between the storage devices and the CPU.
7. **BIOS/UEFI to All Components:** The BIOS/UEFI firmware initializes and communicates with all motherboard components during the boot process. It sets up the system and manages configuration settings.
8. **Power Distribution:** The power supply unit (PSU) connects to the motherboard through power connectors. The motherboard distributes power to all components, ensuring they receive the appropriate voltage and current.
9. **Connectors for Input/ Output (I/O) Ports:** These connectors allow peripheral devices like USB, audio jacks, Ethernet, HDMI, and DisplayPort to communicate with the motherboard and, in turn, the CPU.

10. **Clock Signals:** The clock generator on the motherboard generates various clock signals that synchronize the operation of different components. Timing and synchronization are crucial for proper system operation.
11. **Voltage Regulation:** Voltage regulators on the motherboard ensure that the power supplied to various components remains stable, meeting their specific voltage requirements.

- ✓ **CMOS Battery to CMOS Memory:** The CMOS battery powers the CMOS memory, which stores BIOS settings, date, and time. The BIOS communicates with this memory to retrieve configuration information.
- ✓ **Cooling and Temperature Monitoring:** Sensors on the motherboard monitor temperature, and cooling components (e.g., fans) communicate with the motherboard to adjust their speed based on temperature readings.
- ✓ **On-board Audio and Networking Components:** High-end motherboards often have integrated audio codecs and network controllers. These components communicate with the CPU and RAM for data processing and transmission.

4.Computer system motherboard technologies

- ✓ Computer system motherboard technology has evolved significantly over the years to keep pace with the demands of modern computing. Here are some key aspects of motherboard technology:

1. **Form Factors:** Motherboards come in different form factors, which dictate their size and layout. Common form factors include ATX, Micro ATX, and Mini-ITX. Smaller form factors are often used in compact systems and HTPCs (Home Theater PCs).
    a. ATX: The most common form factor for desktop computers.
    b. MicroATX: A smaller version of ATX, often used in compact or budget-friendly systems.
    c. Mini-ITX: The smallest form factor, commonly used in small form factor (SFF) systems.
    d. Server Motherboards: Designed for high-performance servers with multiple processors and large amounts of memory.
    e. Laptop Motherboards: Smaller and more integrated motherboards designed for laptops.
2. **Chipset Advancements:** Chipsets have become more integrated and efficient. Modern chipsets include the Northbridge and Southbridge functions integrated into a single chip. These chipsets are designed to

support various CPU and peripheral technologies, such as USB, SATA, and PCIe.

3. **CPU Socket and Compatibility:** As CPUs have evolved, so have their sockets. Motherboards need to support specific socket types to accommodate the latest CPU models. For instance, Intel and AMD have introduced various socket designs over the years, and motherboard manufacturers must keep up with these changes.
4. **Expansion Slot Evolution:** Expansion slots, such as PCIe slots, have advanced to support faster data transfer speeds and accommodate modern graphics cards, network cards, and storage devices. The number and type of expansion slots vary based on the motherboard's intended use.
5. **Memory Support:** Motherboards now support various types of RAMS, such as DDR4 and DDR5. They also offer multiple RAM slots, providing support for higher memory capacities and faster data transfer rates.
6. **Storage Connectivity:** Modern motherboards feature connectors for various storage devices, including SATA for hard drives and SSDs, M.2 slots for NVMe SSDs, and, in some cases, U.2 connectors. These connectors support faster data transfer rates and storage technologies.
7. **BIOS/UEFI Firmware:** The BIOS (Basic Input/Output System) has largely been replaced by UEFI (Unified Extensible Firmware Interface) firmware. UEFI offers a more user-friendly interface, faster boot times, and advanced features for hardware configuration.
8. **Connectivity and Ports:** Motherboards now come with a range of I/O ports, including USB 3.0 and USB 3.1, HDMI, DisplayPort, Ethernet, and Wi-Fi. These ports provide faster data transfer, improved video output options, and seamless wireless connectivity.
9. **Multi-GPU Support:** Some motherboards support multiple graphics cards for enhanced gaming and professional graphics performance. Technologies like NVIDIA SLI and AMD Crossfire allow for multiple GPUs to work in parallel.
10. **On-board Audio and Networking:** High-quality integrated audio solutions and network controllers are common on modern motherboards. These components are capable of delivering high-definition audio and fast Ethernet or Wi-Fi connectivity.
11. **Overclocking Features:** Motherboards designed for enthusiasts often include advanced features for CPU and RAM overclocking. These features allow users to push their hardware to higher performance levels.
12. **RGB Lighting and Aesthetics:** Many motherboards feature RGB lighting and customizable aesthetics to cater to gamers and PC enthusiasts looking to personalize the appearance of their systems.

13. **Advanced Cooling Solutions:** Motherboards may include features like fan headers and water pump connectors to support advanced cooling solutions. Some motherboards also offer smart fan control to optimize cooling performance.
14. **Debug and Diagnostic Tools:** Some motherboards include built-in diagnostics, debug LEDs, and on-board buttons for troubleshooting and system tuning.
15. **Security Features:** Modern motherboards often incorporate security features like Secure Boot, Trusted Platform Module (TPM), and hardware-based encryption to protect the system and data.

Theoretical Activity 2.1.2: Identification of common faults of motherboard

Tasks:

1. Discuss and answer the following questions:
   I. What are the common faults categories on motherboard
   II. Describe computer system unit testing**.**
2. Present your findings to the trainer and your colleagues
3. Ask clarifying questions whenever necessary.
4. Read key readings 2.1.2 in trainee's manual

Key readings 2.1.2: Identification of common faults of motherboard

1. Categories of faults on computer system motherboard

1. **Hardware Faults**: These are physical issues that affect the motherboard's components. Examples include:
   - Component failures: Damaged processors, RAM modules, chipsets, or other components.
   - Physical damage: Broken traces, liquid spills, or physical impact.
2. **Software-Related Faults**: These issues arise from software conflicts or incorrect configurations. Examples include:
   - Driver conflicts: Incompatible or outdated device drivers.
   - BIOS errors: Corrupt or misconfigured BIOS settings.
   - Software-induced damage: Malicious software or software crashes can sometimes affect the motherboard.

2.Common Motherboard Faults

Motherboards are crucial components in computer systems, and when they malfunction, it can significantly impact a computer's performance. Here are some common motherboard faults:

1. **Power Supply Issues**

- Insufficient power: The motherboard may not receive enough power from the power supply unit (PSU), leading to instability or crashes.
- Power surges: Sudden voltage spikes can damage components on the motherboard.

2.Overheating

- Excessive heat can damage components on the motherboard, leading to system crashes or performance issues. Ensure proper cooling and ventilation.
- Excessive heat: Overheating can cause components on the motherboard to fail, leading to system instability or crashes.
- Poor cooling: Inadequate cooling systems, such as fans or heat sinks, can contribute to overheating.

3. **Hardware Failures**

- Processor damage: Faulty processors can prevent the motherboard from functioning correctly.
- RAM issues: Defective RAM modules can cause memory errors and system instability.
- Chipset failures: The chipset, which controls communication between components, can malfunction, leading to various problems.

4. **Software Conflicts**

- Driver issues: Incompatible or outdated drivers can cause conflicts with the motherboard and lead to system instability.
- BIOS problems: Corrupt or misconfigured BIOS settings can affect the motherboard's functionality.

5. **Physical Damage**

- Liquid spills: Accidents involving liquids can short-circuit components on the motherboard.
- Physical impact: Dropping or mishandling the computer can cause damage to the motherboard.

6. **Component Failures**

- Capacitor failures: Electrolytic capacitors can leak or fail, leading to various issues.
- MOSFET failures: These power transistors can malfunction, affecting the motherboard's power delivery.

7. **Corrosion**

- Exposure to moisture: Over time, exposure to moisture can cause corrosion on the motherboard, leading to electrical problems.

8. **Manufacturing Defects**

- Faulty components: In rare cases, motherboards can have manufacturing defects that cause issues.

9. **Short Circuits:** These can occur due to damaged traces, liquid spills, or foreign objects on the motherboard. They can cause system instability, unexpected shutdowns, or component failures.

3.Identifying the specific fault often requires a combination of troubleshooting techniques

Pinpointing the exact cause of a motherboard fault often requires a combination of troubleshooting techniques, as the symptoms can be similar for various issues. Here's a breakdown of common methods:

1. Visual Inspection

- **Physical damage:** Look for visible signs of damage, such as bent pins, broken traces, or liquid spills.
- **Corrosion:** Check for signs of corrosion, which can occur due to exposure to moisture or chemicals.

2. Component Testing

- **Processor:** Use diagnostic tools to test the CPU for errors or performance issues.
- **RAM:** Conduct memory tests to identify faulty RAM modules.
- **Chipset:** Check for conflicts or malfunctions by isolating the chipset.
- **Other components:** Test other components like storage devices and expansion cards.

3. BIOS Checks

- **Configuration:** Verify that BIOS settings are correct and not causing conflicts.
- **Updates:** Ensure the BIOS is up-to-date to address known issues.

4. Software Diagnostics

- **Driver conflicts:** Check for driver conflicts using device manager or diagnostic tools.
- **Malware scans:** Scan for malware that might be affecting the motherboard's functionality.
- **Software updates:** Update operating system and software to address known issues.

5. Power Supply Testing

- **Voltage checks:** Use a multimeter to measure the voltage output of the power supply.
- **Load testing:** Test the power supply under load to ensure it can deliver adequate power.

6. Environmental Factors

- **Temperature:** Check if the motherboard is overheating due to inadequate cooling.

- **Humidity:** High humidity can contribute to corrosion and other issues.

7. Process of Elimination

- **Isolate components:** Gradually remove components to identify the faulty one.
- **Test with known-good components:** Replace components with known-good replacements to confirm the issue.

8. Specialized Tools

- **Motherboard diagnostic cards:** These cards can help identify specific hardware faults.
- **Logic analyzers:** These tools can analyze digital signals on the motherboard.

2.1.3. Computer System Unit Testing and Motherboard Issues

Unit testing is a software development process that involves testing individual components of a system in isolation. While it's primarily used for software, it can also be applied to hardware components, including motherboards, to identify and address potential issues.

Here's how unit testing can be used to solve motherboard issues:

1. BIOS Testing

- **Functionality:** Test the basic input/output system (BIOS) to ensure it is functioning correctly. This includes checking boot sequence, hardware detection, and configuration settings.
- **Updates:** Test the latest BIOS updates to see if they resolve any known issues.

2. Chipset Testing

- **Compatibility:** Test the chipset's compatibility with various hardware components, such as processors, memory, and graphics cards.
- **Functionality:** Verify that the chipset is functioning correctly by testing its communication with other components.

3. Memory Testing

- **Stability:** Use memory diagnostic tools to test the RAM modules for errors and stability.
- **Compatibility:** Ensure the RAM modules are compatible with the motherboard's specifications.

4. Processor Testing

- **Performance:** Use benchmarking tools to test the processor's performance and identify any bottlenecks.
- **Overheating:** Monitor the processor's temperature to ensure it's not overheating.

5. Expansion Slot Testing

- **Functionality:** Test the expansion slots to ensure they can accommodate different devices, such as graphics cards and network cards.

- **Compatibility:** Verify that the expansion slots are compatible with the devices being used.

6. I/O Port Testing

- **Functionality:** Test the various I/O ports (USB, Ethernet, audio, etc.) to ensure they are working correctly.
- **Compatibility:** Ensure the ports are compatible with the devices being connected.

7. Power Supply Testing

- **Voltage:** Measure the voltage output of the power supply to ensure it's within specifications.
- **Load testing:** Test the power supply under load to see if it can deliver enough power to the motherboard and other components.

Key characteristics of unit testing:

- **Isolation:** Unit tests are designed to test individual code units independently, without relying on other parts of the system.
- **Automation:** Unit tests are often automated, making it easy to run them.

Theoretical Activity 2.1.3: Description of repair computer system motherboard

Tasks:

1: Answer the following questions:

I. What do you mean of computer tracer repair?
II. Differentiate Soldering and desoldering
III. What are the components board level repair of PCB
IV. What are the components for testing on the motherboard of PC
V. What are the components needed for assembling computer system motherboard

2: Present your findings to the trainer and your colleagues

3: Ask clarifying questions whenever necessary.

4: Read key readings 2.1.4 in trainee's manual

Key readings 2.1.3: Description of repair computer system

1. Computer tracer repair

Computer trace repair on the motherboard is the process of repairing damaged or broken electrical pathways, known as traces, on the motherboard. These traces are tiny copper lines that connect various components on the

motherboard, enabling to conduct electrical signals to flow enabling the components to communicate and function properly.

Common Causes of Trace Damage

- Physical damage: Accidents or mishandling can cause physical breaks in the traces.
- Corrosion: Exposure to moisture, chemicals, or temperatures fluctuation can lead to corrosion, which can degrade the conductivity of the traces.

1. **Manufacturing defects**: occasionally Weak or Thin Traces cause insufficient copper thickness during manufacturing can make traces fragile.
2. **Cleaning:**
   Improper or high-pressure cleaning methods and the use of corrosive or poorly rinsed chemicals during PCB preparation for inspection can degrade or mechanically damage traces.
3. **Bridging the Gap:**
   Typically refers to unintentional connections formed between two or more PCB traces, pads, or components, and this can cause trace damage**.**

2.Soldering and desoldering computer system motherboard

2.1 Soldering:

Soldering is the process of joining two or more metal components together using a filler material called solder, which is a low-melting-point alloy. Soldering is used to create permanent and electrically conductive connections between components and circuit boards.

2.2 Desoldering

Desoldering is the process of removing solder from electronic components, circuit boards, or connections to allow for repairs, replacements, or modifications. It is the reverse of soldering and is commonly performed during PCB rework or when troubleshooting and repairing electronic devices.

Key Differences:

Feature	Soldering	Desoldering
Process	Applying solder to create a bond	Removing solder from a joint
Purpose	Connection, repair	Disassembly, modification
Tools	Soldering iron, solder, flux	Desoldering pump or iron, solder wick

3.Components Board-Level Repair on PCB

Board-level repair on a Printed Circuit Board (PCB) involves working with various components, each of which plays a crucial role in the functioning of electronic devices. Understanding the common components used in board-level repair is essential for identifying and fixing issues. Below is a description of the most common components you may encounter during PCB repair.

1. Resistors

Function: Resistors limit the amount of current flowing through a circuit and help control voltage levels. They are often used in signal conditioning, biasing transistors, and protecting components from excessive current.

- Repair: Damaged resistors can be desoldered and replaced with one of the same resistance values (measured in ohms) and its equivalence.

2. Capacitors

Function: Capacitors store and release electrical energy. They are used for signal filtering, smoothing output voltage fluctuations, and decoupling signals in electronic circuits.

- **Types**:
  - Electrolytic capacitors: Larger, polarized components used for high-capacitance needs (often visible with metal cans).
  - Ceramic capacitors: Small, unpolarised capacitors used for lower capacitance applications.
- **Repair**: Bulging or leaking capacitors (common in older motherboards) should be replaced with capacitors of the same capacitance and voltage rating.

3. Diodes

Function: Diodes allow current to flow in one direction and block it in the opposite direction. They are used for rectification (converting AC to DC), signal demodulation, and protecting components from voltage spikes (as in the case of Zener diodes).

- Types:

1. Standard (Rectifier) Diodes

- **Description:** These are the basic diodes used for rectification in power supplies, allowing current to flow in one direction while blocking it in the opposite direction.
- **Applications:** AC to DC conversion, power supplies, and general-purpose rectification.

2. Zener Diodes

- **Description:** A diode that is designed to operate in reverse breakdown mode (in reverse bias). It has a well-defined **Zener voltage** at which it starts to conduct in reverse, making it useful for voltage regulation.
- **Applications:** Voltage regulation, surge protection, and as a voltage reference.

3. Light Emitting Diodes (LEDs)

- **Description:** These diodes emit light when current flows through them in the forward direction. The light's color depends on the material used to manufacture the diode.
- **Applications:** Displays, indicator lights, lighting, and optoelectronic devices.

4. Schottky Diodes

- **Description:** Made with a metal-semiconductor junction rather than a P-N junction, Schottky diodes have a lower forward voltage drop (typically around 0.2-0.3V) and faster switching speeds compared to standard diodes.
- **Applications:** High-speed switching circuits, power supplies, RF circuits, and solar cells.

5. Photodiodes

- **Description:** A diode that generates current when exposed to light. Photodiodes can operate in reverse bias and are sensitive to light in the visible and infrared spectrum.
- **Applications:** Light detection, optical communication, solar cells, and light sensors.

6. Varactor Diodes (Varicap Diodes)

- **Description:** A diode that behaves like a variable capacitor when reverse biased. Its capacitance varies with the applied reverse voltage.
- **Applications:** Frequency tuning in oscillators, voltage-controlled oscillators (VCOs), and RF circuits.

7. Avalanche Diodes

- **Description:** These diodes are designed to handle high reverse voltages and operate in reverse breakdown mode without damage. They are often used for voltage regulation and protection in high-voltage circuits.
- **Applications:** Voltage regulation, transient voltage suppression, and protection against overvoltage.

8. Shockley Diodes

- **Description:** A four-layer diode that behaves like a switch, typically used in triggering circuits. It can maintain an on or off state until an external trigger is applied.
- **Applications:** Switching applications, phase control in AC circuits, and trigger circuits for SCRs (Silicon-Controlled Rectifiers).

- Appearance: Small cylindrical or surface-mount components with a marking to denote the cathode (negative side).
- Repair: Faulty diodes can cause incorrect voltage levels or prevent current flow and need to be replaced with similar diodes of the same type.

4. Transistors

Function: Transistors act as switches or amplifiers. They control current flow in circuits, allowing them to turn signals on and off or increase signal strength. They are critical for power regulation, amplification, and logic circuits.

- **Types:**

1. Bipolar Junction Transistors (BJT)

- **Construction**: Consist of three layers of semiconductor material: **Emitter**, **Base**, and **Collector**. There are two main types:
    - **NPN**: Negative-Positive-Negative layers.
    - **PNP**: Positive-Negative-Positive layers.
- **Operation**: In a BJT, current flows from the **emitter** to the **collector** through the **base**, and the current flow is controlled by the small current applied at the base.
- **Applications**: Amplifiers, signal modulation, switching applications.

2. Field-Effect Transistors (FET)

- **Construction**: FETs are voltage-controlled devices with three primary regions: **Source**, **Gate**, and **Drain**. The most common types of FETs are:
    - **Junction Field-Effect Transistor (JFET)**
    - **Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET)**
- **Operation**: In FETs, the current flows between the **source** and **drain**, and the voltage applied at the **gate** controls the current flow.
- **Applications**: Switches, amplifiers, voltage regulation, digital logic circuits.

3. Insulated-Gate Bipolar Transistor (IGBT)

- **Construction**: A combination of a MOSFET and a BJT, providing the high input impedance and switching speed of a MOSFET with the high current-carrying capability of a BJT.
- **Operation**: The IGBT is controlled by a voltage at the gate, like a MOSFET, but the current flow is amplified like in a BJT.
- **Applications**: Power electronics (such as inverters, motor drives, and power supplies).

- Appearance: Transistors are often black, three-legged components (either through-hole or surface-mount).
- Repair: Damaged transistors need to be replaced, ensuring the new transistor has the same type and current/voltage specifications.

5. **Integrated Circuits (ICs)**

Function: Integrated circuits are miniature circuits containing many transistors, resistors, capacitors, and diodes on a single chip. They are used for various functions, such as processing data (microcontrollers, processors), amplifying signals, or managing power.

- **Types:**
  - Microcontrollers: Include a CPU, memory, and input/output peripherals in one chip.
  - Operational amplifiers (Op-Amps): Used for amplifying voltage signals.
  - Voltage regulators: Ensure consistent voltage levels for powering other components.
- Appearance: ICs are rectangular chips with many pins on the sides, either in DIP (Dual Inline Package) form or as surface-mount components.
- Repair: Faulty ICs are difficult to repair but can be replaced if a direct equivalent part is available.

6. I**nductors**

Function: Inductors store energy in a magnetic field when current flows and signal follows through them. They are used in power supplies, filters, and tuned circuits to block high-frequency AC signals or smooth power supply outputs.

7. Voltage Regulators

Function: Voltage regulators ensure that components receive a steady and correct voltage, regardless of fluctuations in the power supply. They are essential in power supply circuits for providing stable DC output.

- **Types**:
  - **Linear regulators**: Drop excess voltage to provide a constant output.
  - **Switching regulators**: More efficient, using switching elements and inductors to maintain voltage.
- **Appearance**: Voltage regulators are small rectangular components with three pins (input, ground, and output) and are often mounted on heat sinks.
- **Repair**: Faulty voltage regulators may cause power issues and should be replaced with regulators that match the input/output voltage ratings.

8. Connectors and Sockets

Function: Connectors provide mechanical and electrical connections between components or different parts of the circuit. They include power connectors, I/O ports, and chip sockets.

- **Types**:
  - **Pin headers**: Used for connecting wires or external devices.
  - **USB/HDMI/Ethernet connectors**: Common I/O connectors.
  - **Chip sockets**: For housing integrated circuits.
- **Appearance**: Connectors can vary in size and shape, depending on the type (e.g., USB ports, Ethernet jacks, etc.).
- **Repair**: Damaged connectors can result in loose connections or no signal transfer, and should be resoldered or replaced entirely.

4. Testing of the computer system motherboard component

When testing a motherboard, it's essential to focus on key components that can significantly impact the overall system's performance and functionality. Here are some of the critical components to test:

1. **Central Processing Unit (CPU):**
   - Functionality: Ensure the CPU is correctly installed and functioning properly.
   - Overheating: Check for excessive heat and ensure adequate cooling.
   - Benchmarking: Use benchmarking software to assess the CPU's performance.
2. **Memory (RAM):**
   - Functionality: Verify that all RAM modules are installed correctly and functioning properly.
   - Compatibility: Ensure the RAM is compatible with the motherboard.
   - Error Checking: Use memory diagnostic tools to scan for errors.
3. **Chipset:**
   - Functionality: Check if the chipset is working correctly and communicating effectively with other components.
   - BIOS Updates: Ensure the BIOS is up-to-date to address chipset-related issues**.**
4. **Expansion Slots:**
   - Functionality: Test different expansion slots to ensure they are working properly.
   - Compatibility: Verify that expansion cards are compatible with the motherboard's slots.
5. **I/O Ports:**
   - Functionality: Test USB ports, audio ports, network ports, and other I/O ports to ensure they are working correctly.
   - Connectivity: Verify that devices can be connected and recognized by the system.
6. **BIOS:**
   - Updates: Ensure the BIOS is up-to-date to address potential issues and improve compatibility.
   - Settings: Check BIOS settings for any errors or incorrect configurations.
7. **Power Supply:**
   - Voltage Output: Verify that the power supply is providing the correct voltage to the motherboard.
   - Stability: Ensure the power supply is stable and not causing fluctuations.
8. **Cooling System:**
   - Adequate Cooling: Check that the CPU cooler and case fans are functioning properly to prevent overheating.

5.Components needed for assembling computer system motherboard

Assembling a computer system motherboard involves several steps, and it's a crucial part of building a computer Always work on a static-free surface and ground yourself to prevent damage to components.

- **Refer to Manuals:** Consult the manuals for your motherboard, CPU, and other components for specific instructions.
- **ESD Precautions:** Use ESD tools and techniques to prevent damage to sensitive components.
- **Cable Management:** Organize cables neatly within the case to improve airflow and aesthetics.
- **Test Thoroughly:** After assembly, test all components to ensure they're working properly.

Here's a basic guide to help you through the process:

What You'll Need:

- Motherboard
- CPU (Processor)
- CPU Cooler
- RAM (Memory)
- Power Supply Unit (PSU)
- Storage (HDD/SSD)
- Graphics Card (if not using integrated graphics)
- Computer Case
- Screwdriver
- Anti-static wrist strap (optional, but recommended)

Practical Activity 2.1.4: Perform computer system motherboard troubleshooting

Task:

1: Read the key readings 2.1.4

2: Referring to the key readings 2.1.4, you are requested to perform computer system motherboard troubleshooting. This task should be done individually.

3: Apply precautions

4: Present your work to the trainer and whole class.

5: Ask clarification where necessary

Key readings 2.1.4: Perform computer system motherboard troubleshooting

Troubleshooting a computer motherboard can be a systematic process, as issues can arise from various components. Here's a step-by-step guide to help you through the troubleshooting process:

1. Preparation:

Gather Tools: Have a multimeter, screwdriver, anti-static wrist strap, and possibly a POST (Power-On Self-Test) card ready.

Safety First: Ensure the computer is powered off and unplugged. Use an anti-static wrist strap to prevent static electricity damage.

2. Visual Inspection:

Check for Physical Damage: Look for burnt areas, swollen or leaking capacitors, and broken traces on the motherboard.

Inspect Connections: Ensure all power cables and data connectors are securely attached to the motherboard and components.

3. Power Supply Check:

Test the Power Supply: Use a multimeter to check the output voltages from the power supply. Ensure they are within the acceptable range (+3.3V, +5V, +12V).

Bypass the Power Supply: Short the green wire and any black wire on the 24-pin connector to see if the PSU powers on.

4. Basic Boot Test:

Remove Non-Essential Components: Disconnect all peripherals and non-essential hardware (extra RAM sticks, additional hard drives, etc.) to isolate the problem.

Test with Minimal Configuration: Boot the system with just the CPU, one stick of RAM, and the power supply connected. This helps identify if the motherboard is functional.

5. Check the CPU:

Reseat the CPU: Remove the CPU and check for bent pins (if applicable). Reseat it properly and ensure the cooler is attached.

Test with a Different CPU: If possible, test the motherboard with a compatible CPU to rule out CPU failure.

6.Test RAM:

Reseat RAM Modules: Remove and reseat the RAM sticks to ensure they are properly connected.

Test Each Stick Individually: If multiple RAM sticks are installed, test each one individually in different slots to identify faulty modules or slots.

Use Diagnostic Tools: If the system boots, run memory diagnostic tools like Memtest86 to check for errors.

7. Check for Short Circuits:

Inspect for Shorts: Remove the motherboard from the case and place it on a non-conductive surface to check for shorts.

Check Standoffs: Ensure that all motherboard standoffs are properly placed and not causing any shorts.

8. Test Expansion Slots:

Check PCIe Slots: Insert a graphics card or other expansion cards to test the functionality of the PCIe slots.

Use a POST Card: If available, use a POST card to diagnose issues during the boot process. It can provide error codes that help identify hardware failures.

9. Test I/O Ports:

Check USB and Other Ports: Connect devices to USB, audio, and other ports to ensure they are functioning correctly.

Use Diagnostic Tools: Software tools can help test the functionality of various I/O ports if the system boots.

10. Check BIOS/UEFI:

Check USB and Other Ports: Connect devices to USB, audio, and other ports to ensure they are functioning correctly.

Use Diagnostic Tools: Software tools can help test the functionality of various I/O ports if the system boots

1.Here's a detailed guide on performing trace repairs on a motherboard:

Steps for Trace Repair on a Motherboard:

1. **Identify the Problem:** Determine what issues are occurring with the motherboard (e.g., failure to boot, random crashes).
2. **Gather Tools and Material**: Tools Needed (Soldering iron and solder, Desoldering pump or braid, Multimeter, Utility knife or scalpel, Tweezers)
3. **Prepare the Work Area:** Work in a static-free area to prevent electrostatic discharge (ESD) damage to sensitive components. Use an anti-static wrist strap if available.
4. **Remove Components**: Carefully detach all components connected to the motherboard, including RAM, CPU, and expansion cards.
5. **Use Isopropyl Alcohol:** Clean the area around the damaged trace with isopropyl alcohol and a soft brush to remove dust and debris.
6. **Conductive link:** If the damage is minor (small breaks or cracks), apply conductive ink to bridge the gap in the trace. Allow it to dry according to the manufacturer's instructions.
7. **Check Continuity**: After the repair, use a multimeter to check continuity across the repaired trace to ensure it is functioning properly.
8. **Reassemble the Motherboard**: Reinstall Components

2.A. Soldering motherboard on PC follow steps:

1. **Gather Materials:**

- Soldering iron: A tool that heats the solder.
- Solder wire: The material used to create the solder joint.
- Flux (optional): A chemical agent that helps improve solder flow and adhesion.

2. Prepare the Components:

- Ensure that the components to be soldered are clean and free of contaminants.

3. Heat the Soldering Iron:

- Plug in the soldering iron and allow it to reach the appropriate temperature. The ideal temperature will depend on the type of solder and the components being soldered.

4. Apply Solder:

- Touch the tip of the soldering iron to the joint to heat it.
- Apply solder to the joint, allowing it to melt and flow over the components.
- Remove the solder and then the soldering iron, leaving a clean, smooth joint.

B. When Desoldering a motherboard pass through the following steps:

Desoldering is the process of removing soldered connections from a circuit board or electronic component, allowing you to replace or rework components without damaging the board or surrounding components.

Here are the steps for desoldering a motherboard:

1. **Prepare your workspace.** Make sure you have a clean, well-lit area to work in. Gather your tools, including a desoldering pump, solder sucker, soldering iron, tweezers, and a magnifying glass.
2. **Turn off and unplug your computer.** This is essential to prevent electrical shock.
3. **Remove the motherboard from the case.** Carefully disconnect any cables attached to the motherboard, such as power, SATA, and USB cables.
4. **Identify the component you want to desolder.** This may be a chip, resistor, or other electronic component.
5. **Heat the solder joint with a soldering iron.** Apply the tip of the soldering iron to the solder joint for a few seconds until the solder melts.
6. **Use a desoldering pump to remove the solder.** Place the tip of the desoldering pump over the molten solder and gently squeeze the handle. The pump will suck up the solder.
7. **Remove the component.** Once the solder is removed, you can carefully lift the component off the motherboard.
8. **Clean the area.** Use a damp cloth or cotton swab to clean any residual solder or flux from the motherboard.
9. **Reinstall the motherboard and connect the cables.** Once you have finished desoldering the component, you can reinstall the motherboard and connect the cables.
10. **Test your computer.** Turn on your computer and test the component you desoldered to make sure it is working properly.

In brief Here are the steps for desoldering:

1. **Gather Materials:**

• Desoldering iron or desoldering pump: Tools used to remove solder.

2. **Prepare the Component:**

• Ensure the component you want to remove is accessible and that you can reach the soldered connections.

3. **Heat and Remove Solder:**

• Use a desoldering iron or desoldering pump to heat the solder on the joint, melting it.

• With a desoldering pump, press the trigger while heating the solder, and it will suck up the melted solder.

4. **Remove Component:** After the solder is removed, gently lift or pull the component out of its socket or through-hole.

5. **Inspect and Clean:** Examine the removed component and the board to ensure no damage has occurred. Clean the area to remove any remaining flux or debris.

Practical Activity 2.1.5: Assembling computer system motherboard

Task:

1: Read the key readings 2.1.5

2: Referring to the key readings 2.1.5, you are requested to assemble the computer system motherboard.

3: Apply safety precautions

4: Present your work to the trainer and whole class

5: Ask clarifications where necessary

Key readings 2.1.5: Assembling computer system motherboard

Assembling the Motherboard

Assembling a motherboard involves carefully connecting various components to create a functional computer system. Here's a step-by-step guide:

1. **Prepare the Workspace:**

○ Ensure a clean and static-free environment.

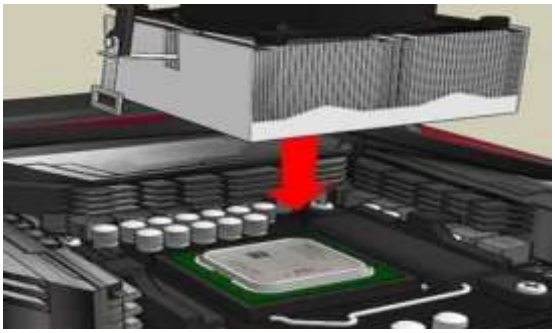
○ Use an anti-static wrist strap to prevent electrostatic discharge (ESD) damage.

2. **Install the CPU:**

○ Open the CPU socket's protective cover.

- Align the CPU with the socket pins and gently press it into place.
- Secure the CPU with the retention mechanism (e.g., clips or screws).

3. **Install the CPU Cooler:**



- Apply thermal paste to the CPU's heat spreader.
- Align the CPU cooler with the socket and secure it in place using the mounting mechanism.

4. **Install RAM:**

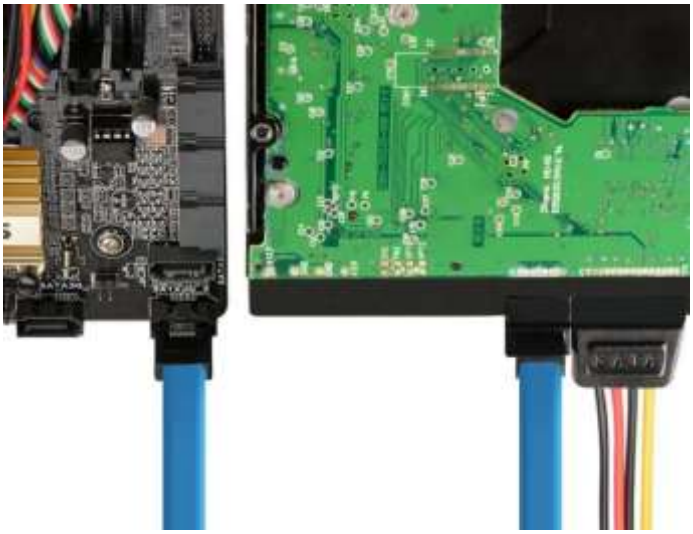
- Locate the RAM slots on the motherboard.
- Ensure the RAM modules are properly oriented and seated in the slots.
- Secure the modules with the retention clips.

5. **Install Expansion Cards:**

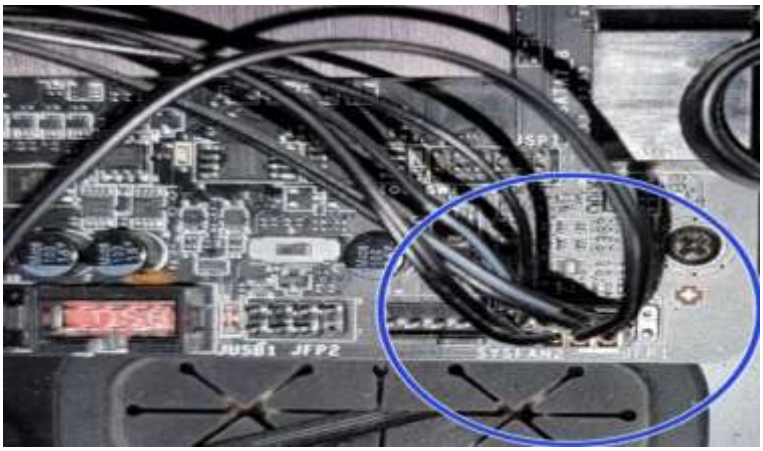
- Insert expansion cards (e.g., graphics card, sound card) into the appropriate slots on the motherboard.
- Secure them with the retention clips.

6. **Connect Storage Devices:**

- Connect hard drives or solid-state drives (SSDs) to the motherboard's SATA ports.
- Secure the storage devices to the chassis.



7. **Connect Other Components:**



- Connect the power supply to the motherboard using the 24-pin ATX connector.
- Connect the front panel connectors (e.g., power button, reset button, USB ports) to the motherboard.
- Connect any other necessary cables (e.g., audio, network).

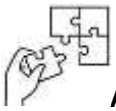
8. **Mount the Motherboard:**
   - Carefully place the motherboard into the computer case, aligning the mounting holes with the standoffs.
   - Secure the motherboard using screws or other fastening mechanisms.

9. **Connect Cables:**
   - Connect the power supply cable to the motherboard.
   - Connect any other necessary cables, such as those for peripherals.
10. **Close the Case:**
   - Secure the side panel of the case and ensure all cables are routed properly.

Points to Remember

- Computer trace repair is the process of repairing damaged or broken conductive traces on a printed circuit board (PCB).
- There is different between soldering and desoldering computer system motherboard where Soldering involves applying molten solder to the joints between electrical components and heating transistors to create a permanent bond. While Desoldering is the process of removing solder from a joint.
- There are the Components board level repair on PCB such as: Diodes, Capacitor, inductor, ICs, Voltage Regulators, Transistors, etc……
- Components testing through to motherboard are: Power Supply, CPU, RAM, Storage Devices, Expansion Cards, cooling system, I/O Ports etc…
- Components needed to assemble motherboard are: CPU, RAM, Storage Devices, Expansion Cards etc…

- Troubleshooting a computer motherboard can be a systematic process, as issues can arise from various components. Here's a step-by-step guide to help you through the troubleshooting process:
  1. Preparation
  2. Power Supply Check
  3. Basic Boot Test
  4. Check the CPU:
  5. Check for Short Circuits
  6. Test I/O Port



Application of learning 2.1

The IT department receives a service request from an employee whose workstation will not boot. Initial checks reveal potential motherboard issues. You are requested to troubleshoot the motherboard to Perform repair computer system motherboard, assembling computer system motherboard and, if necessary, repair or replace it to get the workstation back up and running.

Indicative content 2.2:Perform Computer System Software Troubleshooting

Duration: 10hrs

Theoretical Activity 2.2.1: Description of computer system software Troubleshooting

Tasks:

1: Answer the following questions:

According to the Computer system software troubleshooting, define the following term:

i. Common faults
ii. Data Recovery
iii. Factory reset
iv. Restoration of operating system
v. Upgrading hardware Firmware
vi. Computer system unit testing

2: Present your findings to the trainer and your colleagues

3: Ask clarifying questions whenever necessary.

4: Read key readings 2.2.1 in trainee's manual

Key readings 2.2.1.: Description of computer system software

1.Identify the Common Faults

Common faults in computer systems refer to frequent issues that can affect performance or functionality. These can include hardware failures (like a malfunctioning hard drive or faulty RAM), software errors (such as corrupted files or buggy applications), connectivity problems (like network issues), and power-related issues (like overheating or power supply failures). Identifying these faults involves troubleshooting to determine the root cause of the problem.

2. Data Recovery

Data recovery is the process of retrieving lost, corrupted, or inaccessible data from storage devices such as hard drives, SSDs, USB drives, or backup media. This can be necessary due to accidental deletion, hardware failure, malware attacks, or system crashes. Data recovery methods may include using specialized software tools, hardware repair, or professional data recovery services.

Data recovery software is a specialized tool designed to retrieve lost or deleted data from storage devices such as hard drives, solid-state drives (SSDs), and flash drives.

Performing computer data recovery can be a complex and delicate process, depending on the nature of the data loss and the specific circumstances. Data loss can occur due to various reasons, including accidental deletion, hardware failures, file system corruption, and more.

Recovering data from a faulty motherboard can be challenging and often requires professional assistance. The specific steps involved will depend on the nature of the fault and the extent of the damage.

Here are some general approaches that may be considered:

1. **Data Recovery Services:**
   - **Specialized Companies:** Consider contacting a professional data recovery company. They have specialized tools and expertise to extract data from damaged storage devices, even when the motherboard is faulty.
2. **Hardware Replacement:**
   - **If possible:** If the motherboard fault is isolated and the storage devices are still functional, you might be able to replace the motherboard and recover data from the intact storage devices. This requires technical expertise and careful handling.
3. **Data Extraction Tools:**
   - **Specialized Software:** In some cases, specialized data recovery software can be used to extract data directly from the faulty motherboard, but this is often a complex process and may not be successful in all cases.

Popular Data Recovery Software

- **Recuva:** A free and easy-to-use data recovery tool.
- **EaseUS Data Recovery Wizard:** A comprehensive data recovery software with advanced features.
- **MiniTool Power Data Recovery:** Another popular choice with a user-friendly interface.

3. Factory Reset

A factory reset is a process that restores a device to its original system state as it was when first purchased. This typically involves erasing all data, settings, and installed applications. It is often used to troubleshoot severe issues, prepare a device for resale, or clear personal data before disposal. Factory resets are commonly performed on smartphones, tablets, and computers**.**

There are different ways to reset a computer:

- **Hardware Reset:** Pressing and holding the power button until the computer shuts down and then pressing it again to restart.
- **Software Reset:** Using the "Restart" option within the operating system's menu.
- **Specific Commands:** Some operating systems or devices have specific commands or procedures for resetting.

4. Restoration of Operating System

Restoration of the operating system refers to the process of returning the OS to a previous state or reinstalling it to resolve issues or improve performance. This can involve using recovery media, restoring from a backup, or using built-in system recovery tools. The goal is to restore functionality, fix system errors, or remove malware.

5. Upgrading Hardware Firmware

Upgrading hardware firmware involves updating the embedded software that controls the hardware components of a computer or device. Firmware upgrades can improve performance, add new features, fix bugs, or enhance security. This process typically requires downloading the latest firmware version from the manufacturer's website and following specific instructions to install it.

Performing a firmware upgrade, often referred to as "**flashing**" or "updating" **firmware**, is a process that involves updating the software code that controls the hardware components of a device. Firmware upgrades can provide bug fixes, new features, improved performance, and security enhancements.

Important Considerations Before You Begin:

1. **Backup:** Before upgrading firmware, ensure that you have a backup of any critical data on the device. Firmware updates can sometimes cause data loss or device malfunctions.
2. **Manufacturer's Instructions:** Always follow the manufacturer's instructions and guidelines for firmware updates. These instructions can usually be found on the manufacturer's website or in the product's user manual.
3. **Power and Connectivity:** Ensure the device has a stable power source and is connected to the network (if required) throughout the update process. A power failure or loss of connectivity during a firmware update can cause serious issues.

6. Computer System Unit Testing

Computer system unit testing is a process that evaluates individual components of a computer system, such as the CPU, memory, and storage devices, to ensure they are functioning correctly. This testing may involve running diagnostic software, checking for hardware errors, and verifying performance benchmarks. Unit testing helps identify faults before deploying the system or during maintenance.

Unit testing plays a crucial role in troubleshooting computer system software by providing a structured approach to isolating and identifying specific issues within individual components of the system.

How Unit Testing Aids in Troubleshooting

1. **Isolation of Problems:**
   - **Pinpointing faulty units:** By testing individual components in isolation, unit testing can quickly identify which part of the system is causing the problem.

- **Reduced troubleshooting scope:** This narrows down the area of investigation, saving time and effort.

2. **Verification of Fixes:**

- **Validating changes:** After applying potential fixes or updates, unit tests can verify that the problem has been resolved without introducing new issues.
- **Preventing regressions:** This helps ensure that changes made to address one problem don't inadvertently cause problems elsewhere in the system.

3. **Regression Testing:**

- **Detecting unintended side effects:** Unit tests can help identify unintended consequences of changes made to the system.
- **Maintaining system stability:** This helps maintain the overall stability and reliability of the software.

4. **Root Cause Analysis:**

- **Identifying underlying causes:** By systematically testing different components, unit testing can help uncover the root cause of a problem, rather than just treating the symptoms.
- **Preventing future occurrences:** This enables more effective problem-solving and can help prevent similar issues from occurring in the future.

Common Unit Testing Techniques in Troubleshooting

- **Test-Driven Development (TDD):** Writing tests before writing code can help identify potential issues early in the development process.
- **Behavior-Driven Development (BDD):** Focusing on the desired behavior of the system can help ensure that the software is meeting its intended purpose.
- **White-Box Testing:** Examining the internal structure and logic of the code can help identify potential flaws or inefficiencies.
- **Black-Box Testing:** Testing the system's functionality without considering its internal implementation can help identify external issues or compatibility problems.

Practical Activity 2.2.2: Performing data recovery on computer system

Task:

1: Read the key readings 2.2.2

2: Referring to the key readings (2.2.2) you are requested to go to the computer lab to perform data recovery on PC. This task should be done individually.

3: Apply safety precautions.

4: Present your work to the trainer and whole class

5: Ask clarifications where necessary

Key readings 2.2.2: **Performing data recovery on computer system**

Identification of common fault when performing computer system software troubleshooting

When performing software troubleshooting on a computer system, identifying common faults is crucial for effective resolution. Here are some frequent software-related issues, their potential causes, and troubleshooting steps:

1. **Application Crashes or Freezes**

Symptoms: Applications suddenly close, hang, or become unresponsive.

Potential Causes:

Software bugs or glitches.

Incompatibility with the operating system or other applications.

Insufficient system resources (RAM or CPU).

Troubleshooting Steps:

Restart the application and check for updates.

Uninstall and reinstall the application.

Check system resource usage in Task Manager and close unnecessary programs.

Run the application in compatibility mode.

2. **Operating System Fails to Boot**

Symptoms: The computer does not start the operating system and shows error messages.

Potential Causes:

Corrupted system files or boot configuration.

Recent software installation or updates causing conflicts.

Troubleshooting Steps:

Boot into Safe Mode and try to uninstall recent updates or software.

Use built-in recovery options to repair the operating system.

Run the System File Checker (SFC) tool to fix corrupted files

3. Slow System Performance

Symptoms: The computer takes a long time to respond or load applications.

Potential Causes:

Too many background processes or start-up programs.

Malware infections.

Insufficient disk space or fragmented hard drive.

Troubleshooting Steps:

Open Task Manager to identify and end resource-heavy processes.

Disable unnecessary start-up programs.

Run a malware scan using antivirus software.

Perform disk clean up and defragment the hard drive (for HDDs).

4. Software Update Failures

Symptoms: Updates for the operating system or applications fail to install.

Potential Causes:

Corrupted update files or insufficient disk space.

Network issues or firewall settings blocking updates.

Troubleshooting Steps:

Check for available disk space and clear unnecessary files.

Restart the computer and try the update again.

Temporarily disable antivirus or firewall software and attempt the update.

Manually download and install updates from the official website.

5. Driver Issues

Symptoms: Hardware components (like printers or graphics cards) do not function correctly.

Potential Causes:

Outdated or incompatible drivers.

Corrupted driver files.

Troubleshooting Steps:

Open Device Manager and check for any devices with warning icons.

Update drivers by right clicking the device and selecting "Update driver."

Uninstall and reinstall the problematic driver.

6. Network Connectivity Problems

Symptoms: Unable to connect to the internet or network resources.

Potential Causes:

Incorrect network settings or configurations.

Outdated or corrupted network drivers.

Firewall or security software blocking connections.

Troubleshooting Steps:

Run the network trouble-shooter from the settings menu.

Reset network settings if necessary.

Check and update network adapter drivers.

Temporarily disable firewall or security software to test connectivity.

7. File Corruption or Inaccessibility

Symptoms: Files cannot be opened or display error messages

Here are general guidelines for recovering data on computer system:

Steps for Data Recovery on a PC:

1. **Stop Using the Affected Drive:**
   - To prevent further data loss, avoid writing new data to the drive where the files were lost.
2. **Assess the Situation:**
   - Determine how the data was lost (accidental deletion, formatting, corruption) to choose the best recovery method.
3. **Choose a Data Recovery Method:**
   - Depending on the situation, you can use:
   - Backup Restoration: If you have backups (cloud or external), restore files from there.
   - Data Recovery Software: Use third-party software if no backups are available.
4. **Download and Install Recovery Software:**
   - Select a reputable data recovery tool (such as Recuva, EaseUS Data Recovery Wizard, or Disk Drill).
   - Install the software on a different drive to avoid overwriting lost data.
5. **Run the Data Recovery Software:**
   - Open the software and select the drive or location where the data was lost.
   - Choose a scan option (quick or deep scan) depending on the extent of data loss.
6. **Review the Scan Results:**
   - Once the scan is complete, browse through the recovered files. Most software will categorize them by type (documents, images, etc.).
   - Check for the specific files you want to recover.
7. **Recover the Files:**
   - Select the files you want to restore and choose a recovery location (preferably on a different drive).
   - Follow the prompts to complete the recovery process.
8. **Verify Recovered Data:**
   - After recovery, check the integrity of the files to ensure they are usable and not corrupted.
9. **Backup Important Data:**
   - To prevent future data loss, establish a regular backup routine using external drives or cloud services.
10. **Consider Professional Help (if needed):**
    - If the data is critical and recovery software does not work, consider seeking professional data recovery services.

Practical Activity 2.2.3: Performing factory reset

Task:

1: Read the key readings 2.2.3

2: Referring to the key readings (2.2.3) you are requested to go to the computer lab to perform factory reset. This task should be done individually.

3: Apply safety precautions.

4: Present your work to the trainer and whole class

5: Ask clarifications where necessary

Key readings 2.2.3: Performing factory reset

Performing a factory reset on a computer or device can help restore it to its original settings, erasing all personal data, applications, and custom configurations. Here's a general guide for performing a factory reset on both Windows and macOS systems, as well as on Android and iOS devices.

For Windows:

1. Backup Your Data:

Before proceeding, back up any important files, as a factory reset will erase all data.

2. Open Settings:

Click on the **Start" menu and select "Settings (the gear icon).

3. "Go to Update & Security":

Click on Update & Security.

4. Select Recovery:

In the left sidebar, click on "Recovery".

5. Start Reset Process:

Under the "Reset this PC" section, click the "Get started" button.

6. "Choose an Option":

You'll see two options:

"Keep my files": Removes apps and settings but keeps personal files.

"Remove everything": Removes all personal files, apps, and settings. Choose this for a complete factory reset.

Optionally, choose to "clean the drive" if you plan to sell or give away the computer.

7. Further Options (if you chose "Remove everything"):

Decide whether to remove files from just the drive where Windows is installed or from all drives.

8. Confirm and Reset:

Follow the prompts to confirm your choice and start the reset process. The computer will restart several times.

9. Set Up Windows:

After the reset, you will go through the initial setup process, similar to when you first got the computer

Practical Activity 2.2.4: Restoring operating system

Task:

1: Read the key readings 2.2.4

2: Referring to the key readings (2.2.4) you are requested to go to the computer lab to perform data recovery. This task should be done individually.

3: Apply safety precautions.

4: Present your work to the trainer and whole class

5: Ask clarifications where necessary

Key readings 2.2.4: Restoring operating system

Restoring an operating system can mean different things depending on the context, such as restoring from a backup, repairing the OS, or performing a clean installation. Here's a guide for different scenarios for both Windows.

For Windows:

Option 1: Restore from a Backup

1. Backup Your Data:

Ensure any important files are backed up to avoid data loss.

2. Open Settings:

Click on the "Start" menu and select "Settings" (the gear icon).

3. "Go to Update & Security":

Click on "Update & Security".

4. "Select Backup":

In the left sidebar, click on "Backup".

5. "Restore Files":

If you used File History, click on "More options" under "Back up using File History" and select "Restore files from a current backup".

Option 2: Repair Windows

1. Create a Windows Installation Media:

Download the Windows Media Creation Tool from the Microsoft website and create a bootable USB drive.

2. Boot from Installation Media:

Insert the USB drive and restart your computer. Press the appropriate key to enter the boot menu (often F12, Esc, or Del).

3. Select Repair Your Computer:

Choose “Repair your computer” on the installation screen.

4. Troubleshoot:

Select “Troubleshoot”, then “Advanced options”.

5. Choose Repair Option:

You can select “Startup Repair” or “System Restore” to fix issues.

Option 3: Clean Install Windows

1. Backup Your Data:

Ensure all important files are backed up.

2.Create Installation Media:

Use the Windows Media Creation Tool to create a bootable USB drive.

3. Boot from USB:

Restart your computer and boot from the USB drive.

4. Install Window:

Follow the prompts to install Windows, selecting “Custom” when asked about the installation type for a clean install.

5. “Set Up Windows”:

Once the installation is complete, go through the initial setup process.

Practical Activity 2.2.5: Upgrading firmware

Task:

1: Read the key readings 2.2.5

2: Referring to the key readings (2.2.5) you are requested to go to the computer lab to upgrade firmware. This task should be done individually.

3: Apply safety precautions.

4: Present your work to the trainer and whole class

5: Ask clarifications where necessary

Key readings 2.2.5: Upgrading firmware

Sure, here are the steps required to upgrade firmware on a PC:

1. **Check for firmware updates.**

The first step is to check if there are any new firmware updates available for your PC hardware. You can usually check for updates on the manufacturer's website or by using a utility program.

The first step in upgrading firmware on your PC hardware is to check for any new updates available. Here's how you can do it:

Manufacturer's Website:

- Visit the official website of your PC hardware manufacturer.
- Look for the "Support" or "Downloads" section.
- Search for firmware updates specific to your device model.
- Download the latest firmware update if available.

2. **Download the firmware update.**

Here is an image of a computer screen showing a firmware update download progress bar with the words "Downloading Firmware" above it.

Once you've found the firmware update, the next step is to download it to your computer. Follow these steps:

- Click the download button. The download button will usually be located next to the firmware update file.
- Choose a save location. Select a folder on your computer where you want to save

the firmware update file.

- Wait for the download to complete. The download time will vary depending on the size of the firmware update file and your internet connection speed.

3. **Prepare your PC.**

Before you begin the firmware update process, you will need to prepare your PC. This may involve closing all running programs, disconnecting any external devices, and backing up your important data.

- Close all running programs and applications. This ensures that no programs are interfering with the update process.
- Disconnect any external devices. This includes USB devices, external hard drives, and printers.
- Back up your important data. Firmware updates can sometimes go wrong, so it's crucial to have a backup of your important files just in case.

4. **Start the firmware update.**

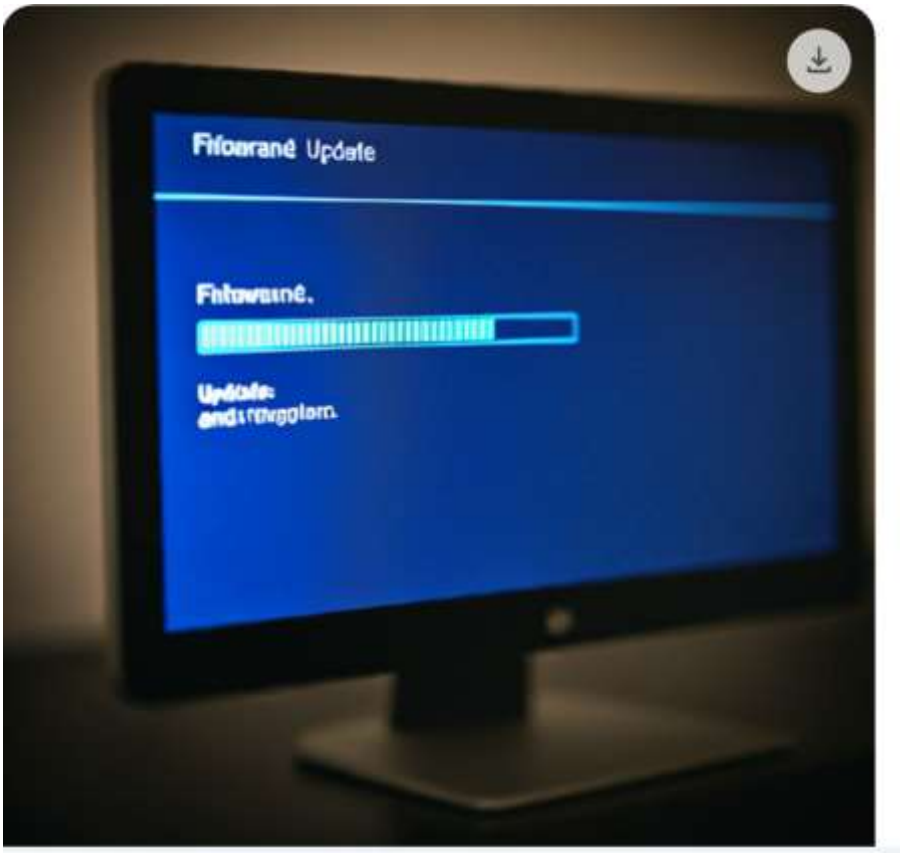
The firmware update process will vary depending on your PC hardware. However, in general, you will need to start the update program and follow the on-screen instructions.

- **Locate the firmware update file.** Find the firmware update file that you

downloaded earlier.

- **Double-click the file.** This will usually launch the update program.
- **Follow the on-screen instructions.** The update program will guide you through the process.
- **Confirm the update.** You may be asked to confirm that you want to proceed with the update.
- **Wait for the update to complete.** The update process may take some time, so be patient.

5. Monitor the update process.



The firmware update process may take some time to complete. It is important to monitor the process and make sure that it is not interrupted.

6. Verify the update.

Once the firmware update is complete, you should verify that it was successful. Y ou can do this by checking the firmware version number or by testing the new fe atures of the firmware.

Points to Remember

- Identify the Common Faults involves diagnosing frequent issues in software systems, such as bugs, compatibility problems, and performance bottlenecks.
- Data recovery refers to the process of retrieving lost or corrupted data from storage devices.
- A factory reset restores a device to its original settings by erasing all data and installed applications.
- Restoration of Operating System is the process involves reinstalling or reverting the operating system to a previous state to fix errors or enhance performance.
- Upgrading firmware involves updating the software that controls hardware components.
- Unit testing evaluates individual components of a computer system to ensure they function correctly.
- Here are the steps to be followed when performing computer system software troubleshoot:
    1. Identification of common faults
    2. Perform data recovery
    3. Perform factory reset
    4. Restoration of operating system
    5. Perform firmware upgrade

Application of learning 2.2

IT support team receives a help desk ticket from an employee who reports that their computer is running slowly, frequently freezing, and that some applications aren't responding. You are requested to identify common faults, perform data recovery, perform factory reset, restore operating system and perform firmware upgrade for resolving it to improve the computer's performance and functionality.

Indicative content 2.3: Perform Computer System Testing

Duration: 5hrs

Theoretical Activity 2.3.1: Description of computer system software and hardware testing

Tasks:

1: Discuss and answer the following questions:

i. Describe hardware testing
ii. Describe software testing

2: Present your findings to the trainer and your colleagues

3: Ask clarifying questions whenever necessary.

4: Read key readings 2.3.1 in trainee's manual

Key readings 2.3.1: Description of computer system software and hardware Perform Computer System Testing

1. Hardware Testing

Hardware testing involves verifying and validating the physical components of a computer system, such as the CPU, RAM, motherboard, hard drives, and other peripheral devices. The goal is to ensure that all components work as intended, are compatible with each other, and can handle expected workloads.

Objectives of Hardware Testing:

Ensure that all physical components are operational.

Detect hardware defects early to prevent system failures.

Validate that the hardware components meet performance benchmarks.

Check the compatibility between hardware components.

Test durability and resistance to stress or failures.

Common Tools for Hardware Testing:

CPU-Z: For detailed information on the CPU, RAM, and motherboard.

MemTest86: For testing RAM integrity.

HWiNFO: For comprehensive hardware diagnostics and monitoring.

CrystalDiskMark: For testing hard drive or SSD performance.

Prime95: For stress testing the CPU under heavy workloads.

Here are some common hardware tests and methods you can use to assess the health of your hardware components:

1. **Visual Inspection:**

Start with a visual inspection to look for loose cables, damaged connectors, or any physical damage to hardware components. This can include checking for loose RAM modules, damaged ports, or bent pins on connectors.

2. **BIOS/UEFI Diagnostics:**
    - Access the BIOS or UEFI setup utility during boot by pressing a designated key (e.g., F2, F12, Delete). Most BIOS/UEFI systems offer built-in diagnostics that can test hardware components such as RAM, CPU, and storage drives.
3. **Memory (RAM) Testing:**
    - Use built-in diagnostic tools like Windows Memory Diagnostic (on Windows) to check the integrity of your RAM modules. These tests can identify memory related issues.
4. **Hard Drive/SSD Testing:**
        - Verify the health of your storage drive (HDD or SSD) using diagnostic software provided by the drive manufacturer or third-party tools like CrystalDiskInfo or HD Tune.

5. **CPU Testing:**
    - Stress tests the CPU to evaluate its stability and performance. Software like Prime95 or Intel Processor Diagnostic Tool can help you do this.
6. **Network and Connectivity Testing:**
    - Confirm that network connections (both wired and wireless) are functioning correctly. You can test network speeds and verify connections to shared resources.
7. **Power Supply Unit (PSU) Testing:**
    - Test the PSU's voltage outputs and stability using a multimeter to ensure its providing consistent and safe power to your components.
8. **Sound and Audio Testing:**

Check audio output by testing your computer's built-in speakers or external audio devices. Make sure sound quality and volume levels are as expected.

9. **USB Port and Data Transfer Testing:**
    - Test USB ports and data transfer speeds by connecting devices and transferring data. Ensure that data is transferred at the expected rate.
10. **Battery Testing (for laptops):**
    - Assess the battery health on laptops by checking its charge capacity and overall condition using built-in diagnostic tools or third-party battery monitoring software.
11. **Power-On Self-Test (POST):**

- Pay attention to any error messages or beep codes that occur during the boot process, as these can provide clues about hardware problems.

2. Software Testing

Software testing ensures that the software running on the computer system works correctly and efficiently, meeting the requirements for functionality, performance, security, and usability. Software testing can be done at different levels and stages of development to catch bugs, performance issues, or security vulnerabilities.

Objectives of Software Testing:

Ensure that software meets functional and performance requirements.

Detect and resolve bugs, errors, or defects in the software.

Validate that the software is secure and does not introduce vulnerabilities.

Verify that the software is compatible with other software and hardware components.

Ensure software stability under various workloads and conditions.

Key Aspects of Software Testing:

Common Tools for Software Testing:

Selenium: For automated web application testing.

JUnit: For unit testing in Java applications.

JMeter: For performance and load testing of web applications.

Postman: For API testing and verification.

Burp Suite: For security testing, particularly for web applications.

Here are common types and methods of software testing:

1.Functional Testing:

- **Unit Testing:** Test individual components or functions of the software to ensure they work correctly.
- **Integration Testing:** Verify that different components or modules of the software interact as expected.
- **System Testing:** Evaluate the entire system to confirm it meets the specified requirements.
- **User Acceptance Testing (UAT):** Let end-users test the software to ensure it meets their needs and expectations.

2.Non-Functional Testing:

- **Performance Testing:** Assess the software's speed, responsiveness, and scalability. Includes load testing, stress testing, and scalability testing.
- **Security Testing:** Identify vulnerabilities and weaknesses in the software to protect it from security threats and breaches.

- **Usability Testing:** Evaluate the software's user-friendliness and user interface design.
- **Compatibility Testing:** Ensure that the software works on various devices, browsers, and operating systems.

Accessibility Testing: Verify that the software is accessible to users with disabilities.

Regression Testing:

- Repeatedly test the software after making changes to ensure that new code doesn't introduce new defects or break existing functionality.

Exploratory Testing:

- Testers explore the software without predefined test cases, allowing them to discover issues that may not be covered by scripted tests.

Ad Hoc Testing:

- Informal testing where testers freely explore the software and perform random tests without predefined test cases.

Comparing Hardware vs. Software Testing

Aspect	Hardware Testing	Software Testing
Focus	• Physical components (CPU, GPU, RAM, Storage)	• Code, programs, applications, and operating system
Objective	• Ensure hardware works under load, meets specs	• Ensure software runs as expected and is bug-free
Tools	• Diagnostics tools (BIOS/UEFI, Prime95)	• Automation tools (Selenium, JUnit, LoadRunner)
Stress Testing	• Tests component durability (e.g., CPU, GPU)	• Ensures software handles extreme workloads
Security	• Checks for physical	• Identifies vulnerabilities in

Practical Activity 2.3.2: Testing computer system hardware

Task:

1: Read the key readings 2.3.2

2: Referring to the key readings (2.3.2) you are requested to go to the computer lab to test computer system hardware. This task should be done individually.

3: Apply safety precautions.

:. Present your work to the trainer and whole class

5: Ask clarifications where necessary

Key readings 2.3.2: Testing computer system hardware

Performing hardware testing on a computer system is essential for diagnosing and ensuring the functionality of various components. Here's a step-by-step guide to effectively test the hardware of a computer system:

Steps to Perform Computer Hardware Testing

1. Preparation:

Gather Tools: You may need a screwdriver, anti-static wrist strap, and diagnostic tools or software (like MemTest86, HWMonitor, or manufacturer-specific utilities).

Backup Data: If applicable, back up any important data to prevent loss during testing.

2. **Visual Inspection:**

Power Off and Unplug: Turn off the computer and unplug it from the power source.

Open the Case: Use a screwdriver to remove the side panel of the case.

Inspect Components: Look for any visible signs of damage, such as burnt components, bulging capacitors, or loose connections.

3. Check Power Supply:

Test Power Supply Unit (PSU): If the computer does not power on, use a power supply tester or a multimeter to check the PSU's output voltages.

Inspect Cables: Ensure all power cables are securely connected to the motherboard and components.

4. Run POST (Power-On Self-Test):

Turn On the Computer: Power on the system and listen for beep codes or observe diagnostic LEDs. Refer to the motherboard manual for beep code meanings.

Observe Boot Behavior: If the system fails to boot, it may indicate hardware issues.

5. Test RAM:

Run Memory Diagnostics: Use tools like Windows Memory Diagnostic or MemTest86 to check for faulty RAM.

Reseat RAM Modules: If issues are detected, try reseating the RAM or testing each module individually in different slots.

6. Check Hard Drive:

Run Hard Drive Diagnostics: Use tools like CrystalDiskInfo or the built-in Windows CHKDSK utility to check the health of the hard drive.

Listen for Noises: Unusual clicking or grinding noises may indicate a failing drive.

7. Test Graphics Card:

Check Connection: Ensure the graphics card is seated properly and that power connectors are attached.

Run Benchmarking Software: Use software like FurMark or 3DMark to stress test the graphics card and check for stability and performance.

8. Inspect Other Peripherals:

Test Input Devices: Check the functionality of the keyboard, mouse, and any other peripherals by connecting them to another system or using different ports.

Test USB Ports: Use known working USB devices to verify that the ports are functioning.

9. Check Cooling System:

Inspect Fans: Ensure all fans (CPU, case, GPU) are operational and free of dust.

Monitor Temperatures: Use software like HWMonitor or Core Temp to check the temperatures of CPU and GPU during operation**.**

10. Run System Diagnostics:

Use Built-in Tools:Many manufacturers provide diagnostic tools that can be run from BIOS/UEFI or as bootable media.

Follow Manufacturer Instructions: Run the diagnostics as per the instructions provided by the hardware manufacturer.

11. Reassemble and Retest:

Close the Case: Once testing is complete, ensure all components are secure, and close the case.

Power On: Turn the computer back on to see if any issues persist.

Practical Activity 2.3.3: Testing computer system software

Task:

1: Read the key readings 2.3.3
2: Referring to the key readings (2.3.3) you are requested to go to the computer lab to test computer system software. This task should be done individually.
3: Apply safety precautions.
4: Present your work to the trainer and whole class
5: Ask clarifications where necessary

Key readings 2.3.3: Testing computer system software

Testing software on a computer system involves several systematic steps to ensure that the software functions correctly and meets the specified requirements. Here's a detailed breakdown of the testing process:

1. **Requirement Analysis:**

Understand Requirements: Review the software requirements to understand what needs to be tested.

Identify Testable Requirements: Determine which requirements can be translated into test cases.

2**. Test Planning:**

Define Objectives: Establish the goals of testing (e.g., functionality, performance, security).

Select Testing Types: choose the types of testing to be performed (e.g., unit testing, integration testing, system testing, acceptance testing).

3. **Test Data Preparation**

The data needed to execute the test cases.

4. Test Environment Setup:

Configure the Test Environment: Set up the hardware and software environment where testing will be conducted.

Install the Software: Deploy the software application in the test environment.

5. Test Execution:

Execute the test cases as per the test plan.

Record the outcomes of each test case, noting any discrepancies between expected and actual results.

6.Defect Reporting:

If any test case fails, log the defect with detailed information (steps to reproduce, screenshots, etc.).

Classify defects based on their severity and impact on the system.

7.Test Closure:

After defects are fixed, retest the affected areas and perform regression testing to ensure that new changes haven't introduced new issues.

Assess the extent of testing to ensure all critical areas have been covered.

Document the testing process, results, and any lessons learned.

8.Review and Feedback:

Hold meetings with the development and testing teams to discuss the testing outcomes.

Computer system software testing involves a systematic approach to ensure that the system meets its requirements and functions as intended.

9.Maintenance:

Update Test Cases: As the software evolves, update test cases to reflect changes in requirements or functionality.

Continuous Testing: Implement automated testing or continuous integration practices to ensure ongoing quality.

Here are the general steps for conducting computer system software testing:

1. Planning the Testing Process

Define Objectives: Determine what you want to achieve with the testing (e.g., validating functionality, ensuring performance).

Identify Scope: Specify the components of the system that will be tested (hardware, software, interfaces).

Create a Test Plan: Outline the testing strategy, resources needed, timelines, and responsibilities.

2. Requirements Analysis

Gather Requirements: Collect functional and non-functional requirements from stakeholders.

Review Requirements: Ensure that the requirements are clear, complete, and testable.

3.Design Test Cases

Develop Test Scenarios: Create high-level scenarios based on the requirements.

Write Detailed Test Cases: For each scenario, write detailed test cases that outline the steps, expected results, and acceptance criteria.

4.Set Up the Testing Environment

Prepare Hardware and Software: Ensure that the necessary hardware, software, and network configurations are in place.

Install the System: Set up the system to be tested, including any required dependencies.

5. Execute Test Cases

Perform Testing: Run the test cases according to the plan, documenting the results.

Record Defects: Log any issues or defects encountered during testing, including steps to reproduce and severity.

6. Verify and Validate

Confirm Fixes: If defects were found, ensure they are addressed and retest the affected areas.

Conduct Regression Testing: Verify that new changes have not adversely affected existing functionality.

7. Performance Testing

Assess Performance Metrics: Conduct tests to measure response times, load handling, and resource utilization.

Analyze Results: Compare performance against established benchmarks and identify any bottlenecks.

8.User Acceptance Testing (UAT)

Involve End Users: Have actual users test the system to validate that it meets their needs and expectations.

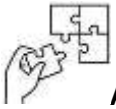
Collect Feedback: Gather insights from users and make necessary adjustments.

9. Final Review and Sign-Off

Point to remember

- Computer system testing is a crucial process to ensure the quality and reliability of a system. It involves both hardware testing and software testing.
- Hardware testing focuses on the physical components of the system, verifying their functionality, performance, compatibility, and environmental resilience.
- Software testing focuses on the applications, operating system, and other software components, testing them individually, together, and as a whole system.
- Steps for Testing Hardware Components on a PC

    1. Gather Tools
    2. Check for Physical Damage
    3. Check Power Supply Unit (PSU
    4. Run Memory Diagnostics
    5. Check Hard Drive/SSD Health
    6. Check for POST (Power-On Self-Test
    7. Peripheral Devices



Application of learning 2.3

ABC Innovations Inc. aims to deliver a reliable and high-performing TechBook Pro laptop to its customers. The results from both testing phases will guide final adjustments and improvements before the product launch, ensuring a positive user experience and reducing post-launch issues. As technicians you required for solving a testing both the hardware and software components, the technician can effectively diagnose and resolve the computer's performance issues, ensuring customer satisfaction.

Learning outcome 2 end assessment

Written assessment

Q1. Choose or cycle the right answer

1. What is the primary function of a motherboard in a computer system?
    A. It stores data and programs.
    B. It processes information.
    C. It connects all the components of the computer.
    D. It displays output on the screen.

5. Which of the following components is typically not directly connected to the motherboard?
    A. CPU
    B. RAM
    C. Power Supply Unit (PSU)
    D. Monitor

6. What is the term for the expansion slots on a motherboard that allow for additional components like graphics cards or sound cards?
    A. Ports
    B. Sockets
    C. Buses
    D. Slots

7. Which of the following factors is most important when choosing a motherboard for a computer build?
    A. Color
    B. Brand
    C. Compatibility with other components
    D. Weight

8. What is the chipset on a motherboard responsible for?
    A. Controlling the flow of data between components
    B. Providing power to the motherboard
    C. Storing BIOS settings
    D. Displaying information on the screen

9. Which type of motherboard is typically used in laptops?
    A. ATX
    B. Micro-ATX
    C. Mini-ITX
    D. BTX

10. Which component is responsible for connecting the motherboard to other devices like keyboards and mice?
    A. CPU

B. RAM
C. I/O ports
D. BIOS

11. What is the difference between a socket and a slot on a motherboard?
    A. Sockets are for larger components, while slots are for smaller ones.
    B. Sockets are used for connecting cables, while slots are for inserting cards.
    C. Sockets are for connecting the CPU, while slots are for connecting RAM.
    D. There is no difference between sockets and slots.
12. Which of the following is not a type of bus used in computer systems?
    A. PCI Express (PCIe)
    B. Serial ATA (SATA)
    C. Universal Serial Bus (USB)
    D. Parallel ATA (PATA)
13. What is the term for the physical connections between components on a motherboard?

    A. Buses
    B. Sockets
    C. Slots
    D. Ports
14. Which component is typically the last to be connected to the motherboard after it is installed in the case?
    A. CPU
    B. Storage drives
    C. Graphics card
    D. Power Supply Unit (PSU)
15. What should be done after completing the assembly of the motherboard to ensure proper functionality?
    A. Install the operating system.
    B. Test the system by booting it up
    C. Clean the case and components.
    D. All the above
16. If a component is not functioning correctly after assembly, what is the first step to troubleshoot the issue?
    A. Replace the component
    B. Check the connections
    C. Update the BIOS
    D. Install a new operating system
17. What is the best way to prevent electrostatic discharge (ESD) damage when handling motherboard components?
    A. Wear an ESD wrist strap
    B. Ground yourself before touching components

C. Avoid touching components with bare hands
D. All of the above

Q2: Fill the empty space

I) _____ is a type of bus used for connecting expansion cards like graphics cards and sound cards.
II) The _____ form factor is the most common standard for motherboards used in desktop computers.
III) _____ motherboards combine multiple components, such as the CPU, GPU, and memory, onto a single chip.
IV) _____ technology helps to improve the efficiency and reduce the power consumption of the motherboard.

Q3. Match the fault in Column A with its corresponding description in Column B.

Column A	**Column B**	**answer**
A. BIOS corruption	I) Damaged or lose power supply connections	**A…..**
B. Overheating	II) Incorrect BIOS settings or firmware updates	**B….**
C .Short circuit.	III) Excessive heat causing component failure	**C…..**
D. Power supply issues	Faulty components or damaged traces on the motherboard	**D…..**

Q4. Match the testing method in Column A with its corresponding description in Column B.

Column A	**Column B**	**answer**
1.Black-box testing	A. Testing based on the internal structure and design of the system	**1….**
2.White-box testing	B. Testing based on the specified input and expected output of the system	**2….**
3. Integration testing |	C. Testing individual components of the system in isolation	**3….**
4.System testing	D. Testing the entire system as a whole	**4….**

5.Regression testing	E. Testing to ensure that changes to the system have not introduced new bugs	**5….**

Q5. True or False

a) Soldering is the process of joining two or more pieces of metal using a heated metal alloy called solder.
b) Desoldering is the process of removing solder from a joint.
c) Using a thermal paste to improve heat dissipation can help prevent motherboard failure.
d) It is always necessary to remove the motherboard from the computer case before soldering or desoldering components.
e) Solder flux helps to clean the metal surfaces before soldering and prevents oxidation.

Practical assessment

You have been asked to set up Computer system refer to hardware and software maintenance in **XYZ computer lab**. The users will not be using the computers because they have some issues relates to motherboard issues and software upgrading on system operating system or software not update. **XYZ** have been hired by a company, **ABC Solutions Inc.**, to solve those problem in order to perform in good condition as desoldering motherboard, soldering motherboard, assembling motherboard, reinstall, upgrade firmware, and update any application on computer system

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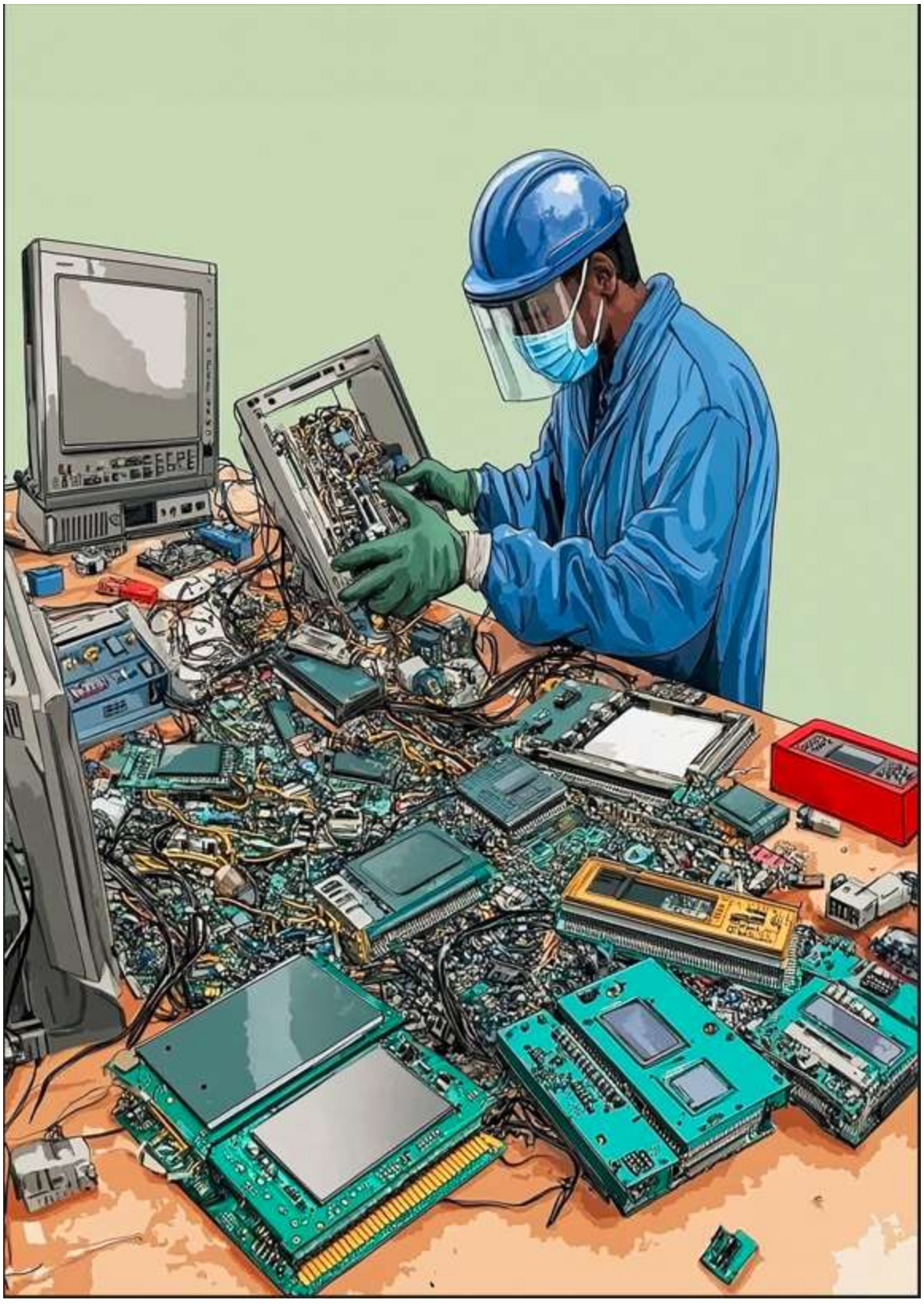


Indicative Contents
3.1 Identification of Computer System Transformation Requirement
3.2 Applying Computer System Transformation Techniques
3.3 Assembling New Computer System
3.4 Perform Computer System Test
3.5 Elaboration of System Report

Key Competencies for Learning Outcome 3: Perform Computer System Conversion

Knowledge	Skills	Attitudes
• Description of computer system transformation • Description of computer system components • Description of Computer system transformation techniques • Description of computer system test	• Applying Computer system transformation techniques • Assembling new computer system • Performing computer system test. • Elaborating System report	• Being Innovative • Having organization • Having safety First • Having flexibility • Having time Management • Being Problem Solving • Being Self-motivated • Being Detail-oriented

Duration: 20hrs

Learning outcome 3 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe correctly computer system transformation based on computer system functionality.
2. Identify appropriately computer system components based on repurposing goals.
3. Identify appropriately computer system transformation techniques based on computer system functionality.
4. Describe correctly computer system test based on system expected functionality.
5. Apply properly Computer system transformation techniques based on intended use.
6. Assemble properly new computer system based on repurposing goals.
7. Perform successfully System testing based on system expected functionality.
8. Elaborate effectively Refurbishment report based on work done

Resources

Equipment	Tools	Materials
• Power supply tester • Oscilloscope • Multi-meter • Function generator • Anti-static mat • SMD rework station • Blower	• Tweezers • Screwdrivers • Soldering iron • Desoldering pump • Flashlight or headlamp • Needle-nose pliers • Wire cutter/striper	• Anti-static wrist strap/mat • Thermal paste • Isopropyl alcohol and cotton swabs • Soldering wire (tin) • Labelling materials • Spare screws • Soldering paste • Electrical tape and zip ties • Desoldering wick

Indicative content 3.1: Identify Computer System Transformation Requirements

Duration: 4 hrs

Theoretical Activity 3.1.1: Description of computer system transformation

Tasks:

1: Answer the following questions:

i. Define computer system transformation
ii. Describe the purpose computer system transformation
iii. What are the computer system technologies?
iv. Identify computer system components**.**

2: Provide the answers for the asked questions and write them on flipchart/papers.

3: Present the findings/answers to the whole class.

4: For more clarification, read the key readings 3.1.1.

Key readings 3.1.1 Description computer system transformation

Description computer system transformation

1. Computer system transformation

1.1 Definition

A computer system transformation refers to a significant change or upgrade to the infrastructure, architecture, or functionality of a computer system.

1.2 Purpose computer system transformation

- **Improving Performance**: Upgrading hardware and software to increase the speed, efficiency, and reliability of the system.
- **Enhancing Security:** Implementing modern security measures to protect against cyber threats, data breaches, and other vulnerabilities.
- **Increasing Scalability:** Ensuring that the system can handle increased loads and can be easily expanded as the organization grows.
- **Cost Efficiency:** Reducing operational costs through more efficient use of resources, such as energy, storage, and processing power, often by adopting cloud solutions or virtualization.
- **Ensuring Compliance:** Updating systems to meet current regulatory and industry standards, ensuring legal and ethical compliance.
- **Facilitating Innovation:** Providing a robust and flexible IT environment that supports new technologies and innovative practices, allowing the organization to stay competitive.

- **Supporting Business Goals:** Aligning IT capabilities with the strategic goals of the organization to drive business success and growth.
- **Enabling Digital Transformation:** Integrating digital technologies into all aspects of the business to transform operations, improve customer interactions, and create new business models.

1.3 Computer system technologies

A computer system technology is comprised of various components and technologies that work together to perform computing tasks. These computer system technologies can be broadly categorized into hardware, software, and network technologies.

1.3.1. Computer System Hardware Technologies

Central Processing Unit (CPU): The brain of the computer that performs calculations and processes instructions. Innovations include multi-core processors for improved performance and efficiency.

Memory (RAM and Storage): RAM (Random Access Memory) provides temporary storage for data being processed, while storage (HDDs and SSDs) retains data long-term. Advances include faster and larger storage options, such as NVMe SSDs.

Motherboards: The main circuit board that connects all components. Technology improvements focus on integration and supporting more devices, such as USB-C and Thunderbolt ports.

Graphics Processing Units (GPUs): Specialized processors designed for rendering graphics. They have evolved for use in gaming, AI, and deep learning applications.

Input/Output Devices: These include peripherals like keyboards, mice, monitors, and printers. Recent advancements include touchscreens, voice recognition, and virtual reality devices.

1.3.2. Computer System Software Technologies

Operating Systems (OS): Software that manages hardware and software resources. Popular OSs include Windows, macOS, and Linux. Trends include increased security features and support for cloud computing.

Application Software: Programs designed to perform specific tasks, such as word processors, spreadsheets, and database management systems. Software-as-a-Service (SaaS) is increasingly popular.

Development Tools: Software that helps developers create applications, including Integrated Development Environments (IDEs), version control systems, and testing frameworks. Innovations focus on automation and collaboration features.

Middleware: Software that connects different applications or services, enabling communication and data management between them. It plays a crucial role in distributed systems and microservices architecture.

1.3.3 Computer System Network Technologies

Networking Hardware: Devices such as routers, switches, and access points that connect computers and other devices. Innovations include high-speed Ethernet, Wi-Fi 6, and 5G technology for faster and more reliable connections.

Network Protocols: Sets of rules that govern data communication over networks. Common protocols include TCP/IP, HTTP, and FTP. Advancements focus on enhancing security (e.g., HTTPS) and improving data transmission efficiency.

Cloud Computing: The delivery of computing services (storage, processing, etc.) over the internet. Technologies like virtualization and containerization enable scalable and flexible resource management.

Cybersecurity: Technologies and practices designed to protect networks and data from unauthorized access or attacks. This includes firewalls, encryption, and intrusion detection systems.

2.Identification of computer system components

2.1. Hardware Components

1. **Central Processing Unit (CPU)**:
- The primary processor that executes instructions and performs calculations.
- Technologies: Multi-core processors, hyper-threading, advanced microarchitecture.
2. **Memory (RAM)**:
- Volatile memory used to store data and instructions temporarily while a computer is in use.
- Technologies: DDR (Double Data Rate) SDRAM, LPDDR (Low Power DDR).
3. **Storage**:
- Non-volatile memory used to store data permanently.
- Technologies: Hard Disk Drives (HDDs), Solid State Drives (SSDs), NVMe (Non-Volatile Memory Express).
4. **Motherboard**:
- The main circuit board that connects and allows communication between all components.
- Technologies: PCIe (Peripheral Component Interconnect Express), USB (Universal Serial Bus).
5. **Graphics Processing Unit (GPU)**:
- Specialized processor for rendering images and videos.
- Technologies: CUDA (Compute Unified Device Architecture), Ray tracing, AI-enhanced rendering.

6. **Power Supply Unit (PSU)**:

- Converts electrical power from an outlet into usable power for the computer's components.
- Technologies: Modular PSUs, 80 Plus certification.

7. **Input/output Devices**:

- Devices used for user interaction and data input/output.
- Technologies: Touchscreens, mechanical keyboards, high-DPI mice, VR headsets.

2.2. Software Components

System software:

The software that manages hardware resources and provides services for application software.

Technologies: Virtualization, containerization, microkernels.

Application Software:

Programs that perform specific tasks for users.

Technologies: Cloud-based applications, AI-driven applications, cross-platform development.

Point to remember

- A computer system transformation refers to a significant change or upgrade to the infrastructure, architecture, or functionality of a computer system.
- Purpose of Computer System Transformation are improving Performance, Enhancing Security, Increasing Scalability, Cost Efficiency, Facilitating Innovation
- The computer system technologies can be broadly categorized into: Computer System Hardware Technologies, Computer System Software Technologies, and Computer System Network Technologies
- Computer system components are classified based on: Hardware Components and software components.

Indicative content 3.2: Applying Computer System Transformation Techniques

Duration: 4 hrs

Theoretical Activity 3.2.1: Identification of computer system transformation techniques

Tasks:

1: Discuss and answer the following questions:

i.What are the categories of Computer system transformation techniques?

ii. Where computer system transformation techniques be applied?

2: Present your findings to the trainer and your colleagues

3: Ask clarifying questions whenever necessary.

4: Read key readings 3.2.1 in trainee's manual.

Key readings 3.2.1: Identification of computer system transformation techniques

Categories of Computer system transformation techniques:

1.Software based

2.Hardware based

3.Networking and connectivity

4.Hybrid

1.1. Software-Based Transformation Techniques

Refactoring: Improving the internal structure of existing code without altering its external behaviour to enhance maintainability and performance.

Modularization: Dividing applications into smaller, independent modules or services that can be developed and deployed separately.

Cloud Migration: Moving software applications to cloud environments to leverage scalability, flexibility, and cost savings.

Microservices Architecture: Transitioning from monolithic applications to microservices that allow for independent scaling and development.

Continuous Integration/Continuous Deployment (CI/CD): Automating the testing and deployment processes to facilitate frequent and reliable software updates.

API Development: Creating application programming interfaces (APIs) to enable integration with other services and enhance interoperability.

1.2. Hardware-Based Transformation Techniques

Upgrading Hardware: Replacing or upgrading existing hardware components (e.g., CPUs, RAM, storage) to improve performance and efficiency.

Virtualization: Using hypervisors to create virtual machines that allow multiple operating systems to run on a single physical machine, improving resource utilization.

Converged Infrastructure: Integrating computing, storage, and networking into a single solution to simplify management and increase efficiency.

Edge Computing: Deploying computing resources closer to the data source to reduce latency and bandwidth usage, improving response times for applications.

Hardware Acceleration: Utilizing specialized hardware (like GPUs or FPGAs) to enhance the performance of specific applications, such as machine learning or data processing.

1.3. **Networking and Connectivity Transformation Techniques**

Network Upgrades: Enhancing network infrastructure (e.g., upgrading routers, switches, and cabling) to support higher speeds and greater reliability.

Software-Defined Networking (SDN): Implementing SDN to enable more flexible and efficient network management by decoupling the control plane from the data plane.

Network Function Virtualization (NFV): Virtualizing network services (like firewalls, load balancers) to run on standard hardware instead of dedicated appliances, improving scalability and reducing costs.

Wi-Fi 6 and 5G Implementation: Upgrading to the latest wireless technologies to enhance connectivity, speed, and capacity for mobile and IoT devices.

Cloud Networking: Utilizing cloud-based networking solutions to improve connectivity and manage traffic across distributed systems.

1.4. Hybrid Transformation Techniques

Hybrid Cloud Solutions: Combining on-premises infrastructure with public and private cloud resources to achieve flexibility, scalability, and cost-effectiveness.

Multi-Cloud Strategies: Using multiple cloud service providers to avoid vendor lock-in and optimize performance based on specific workloads.

Edge and Cloud Integration: Creating a hybrid model that leverages both edge computing for real-time processing and cloud resources for storage and analytics.

Unified Communications: Integrating various communication methods (voice, video, messaging) across both on-premises and cloud environments to enhance collaboration.

Cross-Platform Development: Developing applications that can run on multiple platforms (e.g., mobile, web, desktop) to reach a wider audience while optimizing development resources

2. Computer system transformation techniques be applied in:

1. **Enterprise IT Infrastructure:**

Data Centers: Upgrading and optimizing server hardware, storage solutions, and networking components to improve performance and reduce costs.

Cloud Services: Migrating applications and data to cloud environments for scalability, flexibility, and cost savings.

2. Software Development:

Application Development: Implementing agile methodologies, microservices architecture, and CI/CD practices to improve software delivery and quality.

Legacy System Modernization: Refactoring or rewriting legacy applications to enhance maintainability and performance.

3. Healthcare:

Electronic Health Records (EHR): Transforming EHR systems to improve data accessibility, interoperability, and user experience.

Telemedicine Solutions: Enhancing software and connectivity for remote patient monitoring and virtual consultations.

4. Finance and Banking:

Payment Processing Systems: Modernizing payment systems to improve transaction speed and security, including the adoption of block chain technology.

Risk Management Systems: Upgrading analytical tools and data processing capabilities to better manage financial risks.

5. **Retail and E-Commerce:**

Inventory Management: Implementing real-time inventory tracking systems using IoT and cloud solutions for improved efficiency.

Customer Experience: Enhancing e-commerce platforms with personalized recommendations and seamless payment options.

6. Manufacturing:

Smart Manufacturing: Utilizing IoT and edge computing to optimize production processes and monitor equipment in real-time.

Supply Chain Management: Transforming supply chain systems for better visibility and efficiency through data analytics and cloud solutions

7. **Telecommunications:**

Network Upgrades: Implementing 5G technology and SDN to enhance connectivity and support a growing number of devices.

Service Virtualization: Using NFV to virtualize network services, allowing for more flexible and cost-effective service delivery.

8. Education:

Learning Management Systems (LMS): Upgrading LMS platforms to improve user experience and incorporate new educational technologies.

Remote Learning Solutions: Enhancing connectivity and software tools to support online education and collaboration.

9. **Government and Public Sector:**

E-Government Services: Transforming public service delivery through digital platforms and improved data management.

Cybersecurity Enhancements: Upgrading security systems and protocols to protect sensitive data and infrastructure.

10. Research and Development:

Data Analysis: Implementing advanced data analytics and machine learning techniques to enhance research capabilities and insights.

Collaboration Tools: Using hybrid solutions to facilitate collaboration among researchers across different locations.

Practical Activity 3.2.2: Applying computer system transformation techniques

Task:

1: Read the key reading 3.2.2

2: Referring to the key reading 3.2.2 you are requested to go in computer lab to apply computer system transformation techniques.

3: Present your work to the trainer and whole class.

4: In addition, ask questions where necessary.

Key readings 3.3.2: Applying computer system transformation techniques

Using computer system transformation techniques involves a structured approach to transitioning from one system or architecture to another. Here are the key steps to effectively implement this process:

1. **Assessment and Planning**

- **Analyze Current Systems**: Evaluate the existing system's architecture, functionality, and performance.
- **Define Objectives**: Clearly outline the goals for transformation, such as improving efficiency, scalability, or user experience.
- **Identify Stakeholders**: Engage stakeholders (management, users, IT staff) to gather requirements and expectations.

2. **Select Transformation Techniques**

- **Choose Appropriate Techniques**: Depending on your needs, select from various techniques such as:

Software based: Software-based transformation involves leveraging software solutions to optimize and modernize applications and processes.

Hardware based: Hardware-based transformation focuses on upgrading and optimizing physical components to improve performance and efficiency.

Networking and connectivity: These techniques aim to enhance network performance, flexibility, and connectivity.

Hybrid: Hybrid transformation techniques combine elements of various approaches to achieve optimal flexibility and performance.

3. **Create a Detailed Plan**

- **Develop a Transformation Roadmap**: Outline the steps, timelines, and resources required for the transformation process.
- **Allocate Resources**: Determine the budget, personnel, and tools needed for the transformation.

4. **Design the New System**

- **Architectural Design**: Create a design for the new system architecture, considering scalability, security, and performance.
- **Technology Selection**: Choose appropriate technologies and platforms that align with the objectives.

5. **Implementation**

- **Build the New System**: Develop the new system components based on the design.
- **Data Migration**: Plan and execute the transfer of data from the old system to the new one, ensuring data integrity and consistency.
- **Testing**: Conduct rigorous testing (unit, integration, system, and user acceptance testing) to identify and fix issues before deployment.

6. Deployment

- **Rollout Strategy**: Decide on a deployment strategy (big bang, phased, pilot) and execute it.
- **Monitor Performance**: Continuously monitor the new system's performance and address any issues that arise.

7. Post-Implementation Review

- **Evaluate Success**: Assess the transformation process against the initial objectives.
- **Gather Feedback**: Collect feedback from users and stakeholders to identify areas for improvement.
- **Iterate and Optimize**: Make necessary adjustments based on feedback and performance metrics.

Here are the general steps involved for different types of transformations:

1.Software-Based Transformation

1. **Identify the need:** Determine the specific areas where software improvements can enhance the system's capabilities.
2. **Assess current software:** Evaluate the existing software infrastructure, including its limitations and potential for optimization.
3. **Select transformation techniques:** Choose appropriate techniques based on the identified needs, such as:

- **Software upgrades:** Install newer versions of software components to benefit from updated features and security patches.
- **Patch management:** Apply patches and updates regularly to address vulnerabilities and improve performance.
- **Configuration optimization:** Fine-tune software settings to optimize resource utilization and performance.
- **Software virtualization:** Create virtual instances of software to improve flexibility, scalability, and resource management.

- **Cloud migration:** Move software applications to a cloud environment to leverage cloud-based services and infrastructure.

4. **Implement and test:** Implement the selected techniques, ensuring compatibility with the existing system. Conduct thorough testing to validate the changes and identify any potential issues.

5. **Monitor and maintain:** Continuously monitor the system's performance and address any emerging problems. Implement ongoing maintenance and updates to ensure optimal operation.

2.Hardware-Based Transformation

1. **Identify hardware limitations:** Determine the bottlenecks or constraints that are hindering the system's performance.

2. **Assess hardware options:** Evaluate available hardware components and their suitability for the desired improvements.

3. **Select transformation techniques:** Choose appropriate techniques based on the identified limitations, such as:

- **Hardware upgrades:** Replace outdated or underperforming hardware components with newer, more powerful ones.
- **Hardware consolidation:** Combine multiple physical servers into a single, more efficient system.
- **Hardware virtualization:** Create virtual machines on a single physical server to improve resource utilization and flexibility.
- **Data center modernization:** Upgrade the entire data center infrastructure to improve efficiency, scalability, and reliability.

4. **Implement and test:** Install and configure the new hardware components, ensuring compatibility with the existing system. Conduct thorough testing to verify the changes and identify any potential issues.

5. **Monitor and maintain:** Continuously monitor the system's performance and address any emerging problems. Implement ongoing maintenance and updates to ensure optimal operation.

3.Networking and Connectivity Transformation

1. **Identify network bottlenecks:** Determine the areas where network performance is limiting the system's capabilities.

2. **Assess network infrastructure:** Evaluate the existing network infrastructure, including its capacity, topology, and security measures.

3. **Select transformation techniques:** Choose appropriate techniques based on the identified bottlenecks, such as:

- **Network upgrades:** Increase network bandwidth, improve latency, or enhance security features.
- **Network optimization:** Fine-tune network settings to optimize traffic flow and reduce congestion.

- **Network virtualization:** Create virtual networks to improve flexibility and isolation.
- **Wireless network deployment:** Implement wireless networks to provide connectivity in areas where wired connections are impractical.

4. **Implement and test:** Install and configure the new network components, ensuring compatibility with the existing system. Conduct thorough testing to verify the changes and identify any potential issues.
5. **Monitor and maintain:** Continuously monitor network performance and address any emerging problems. Implement ongoing maintenance and updates to ensure optimal operation.

4.Hybrid Transformation

1. **Identify hybrid benefits:** Determine the specific advantages that a hybrid approach can provide, such as increased flexibility, scalability, or cost-effectiveness.
2. **Assess existing infrastructure:** Evaluate the current system's suitability for a hybrid approach, including its compatibility with cloud-based services.
3. **Select transformation techniques:** Choose appropriate techniques based on the identified benefits, such as:
   - **Hybrid cloud migration:** Move selected applications or workloads to a public cloud while retaining others on-premises.
   - **Hybrid cloud integration:** Integrate on-premises and cloud-based resources to create a unified environment.
   - **Hybrid cloud disaster recovery:** Implement a hybrid cloud disaster recovery plan to ensure business continuity.
4. **Implement and test:** Implement the hybrid transformation, ensuring compatibility between on-premises and cloud-based components. Conduct thorough testing to verify the changes and identify any potential issues.
5. **Monitor and maintain:** Continuously monitor the hybrid system's performance and address any emerging problems. Implement ongoing maintenance and updates to ensure optimal operation.

Point to remember

- There are transformation techniques such as: software based, hardware based, networking and connectivity, Hybrid.
- There are primary uses of Computer system transformation techniques which are: Modernization, Performance Optimization, Cost Reduction, Enhanced Security, Scalability, Integration, and Innovation
- While using computer system transformation techniques involves a structured approach to transitioning from one system or architecture to another.
- Here are the key steps to effectively implement this process:

1. Assessment and Planning,
2. Select Transformation Techniques,
3. Create a Detailed Plan,
4. Design the New System,
5. Implementation,
6. Deployment,
7. Post-Implementation Review

Application of learning 3.2

ABC Solutions Inc. is a mid-sized technology consulting firm that provides IT services and software solutions to clients across various industries. The company has been experiencing rapid growth, leading to challenges in managing its internal systems, workflows, and customer relationships. To address these challenges, ABC Solutions is requesting you as technician to implement various computer system transformation techniques.

Duration: 4 hrs

Practical Activity 3.3.1: Assembling new computer system

Task:

1: Read the key reading 3.3.1

2: Referring to the key reading 3.3.1 you are requested to go in computer lab to assemble computer system.

3: Present your work to the trainer and whole class.

4: In addition, ask questions where necessary.

5: Perform the activity in the application of learning 3.3

Key readings 3.3.1: Assembling new computer system

Steps to apply computer system assembling precaution.

1. Ensure that you wear the appropriate safety equipment, such as gloves and safety glasses, when assembling communication equipment.
2. Read the safety warnings and instructions in the manual before attempting to assemble the equipment.
3. Make sure you are familiar with the equipment and its components before attempting to assemble it.
4. Make sure the area you are assembling the equipment in is free from dust and other contaminants.
5. Unplug any power supplies and disconnect any cables before beginning assembly.
6. Check all connections and cables for proper fit and secure them before powering up the equipment.

Steps to assemble a new computer system

1. Gather Your Components:

- **CPU:** The brain of your computer.
- **Motherboard:** The base that connects everything.
- **RAM:** Short-term memory for the CPU.
- **Storage:** Hard drive or SSD for long-term storage.
- **Graphics Card:** For high-quality visuals (optional for basic tasks).
- **Power Supply Unit (PSU):** Provides power to all components.
- **Case:** Houses all components.
- **Cooling System:** CPU cooler and case fans (optional for basic setups).

2. Prepare Your Workspace:

- Choose a clean, static-free environment.
- Have a screwdriver and possibly a pair of tweezers handy.
- Ground yourself to avoid damaging components.

3. Install the CPU:

- Open the CPU socket on the motherboard.
- Remove the protective cover from the CPU.
- Align the pins correctly and gently insert the CPU into the socket.
- Secure the CPU with the retention mechanism.

4. Install the CPU Cooler:

- Apply thermal paste to the CPU.
- Align the cooler with the CPU socket and secure it according to the manufacturer's instructions.

5. Install the RAM:

- Locate the RAM slots on the motherboard.
- Ensure the RAM modules are oriented correctly.
- Push the modules firmly into the slots until they click into place.

6. Install the Motherboard into the Case:

- Align the motherboard with the mounting points in the case.
- Secure the motherboard using screws.
- Connect any necessary cables from the case to the motherboard, such as the front panel connectors.

7. Install the Storage Devices:

- Mount the hard drive or SSD into the designated bays in the case.
- Connect the storage device's data cable to the motherboard and the power cable to the PSU.

8. Install the Graphics Card (if applicable):

- Locate the PCIe slot on the motherboard.
- Remove the protective cover (if present).
- Insert the graphics card into the slot and secure it with a retention clip.
- Connect the power cables from the PSU to the graphics card (if required).

9. Install the Power Supply Unit:

- Mount the PSU into the designated space in the case.
- Connect the PSU's main power cable to the motherboard.
- Connect the power cables from the PSU to the other components (CPU, motherboard, storage, graphics card).

10. Connect Peripherals:

- Connect your monitor, keyboard, mouse, and other peripherals to the appropriate ports on the motherboard or graphics card.

11. Power On and Test:

- Plug in the power cord to the PSU and the case.
- Press the power button on the case.
- If everything is connected correctly, the system should boot up.

Points to Remember

Steps to assemble a new computer system

1. Gather Your Components
2. Prepare Your Workspace
3. Install the CPU
4. Install the CPU Cooler
5. Install the RAM
6. Install the Motherboard into the Case
7. Install the Storage Devices
8. Install the Graphics Card (if applicable)
9. Install the Power Supply Unit
10. Connect Peripherals
11. Power On and Test

Application of learning 3.3

As a technician in a technical institution, you are requested to assemble a new computer system. And you must follow the institution's safety protocols and assembling precautions to avoid damaging components and ensure a successful build.

Indicative content 3.4: Perform Computer System Test

Duration: 4 hrs

Theoretical Activity 3.4.1: Description of computer system test

Tasks:

1: Provide clear explanation about:

i.System Compatibilities

ii.System performance

iii.System functionality

2: Provide the answer for the asked questions and write them on papers.

3: Present the findings/answers to the whole class

4: For more clarification, read the key readings 3.4.1. In addition, ask questions where necessary.

Key readings 3.4.1.: Description of computer system test

1. System Compatibilities

System compatibility refers to the ability of different components within a computer system to work together seamlessly. This includes:

i. **Hardware compatibility:** Ensuring that various hardware components (e.g., CPU, GPU, RAM, storage devices) are compatible with each other and with the system's motherboard.

ii. **Software compatibility:** Verifying that different software applications and operating systems can run smoothly on the system without conflicts or errors.

iii. **Driver compatibility:** Ensuring that the necessary drivers for hardware devices are installed and compatible with the operating system.

2.System Performance

System performance refers to how well a computer system performs tasks. It involves factors such as:

- **Processing speed:** The speed at which the CPU can execute instructions.
- **Memory capacity:** The amount of RAM available for storing data and running applications.
- **Storage speed:** The speed at which data can be read from and written to storage devices (e.g., hard drives, SSDs).
- **Graphics performance:** The ability of the GPU to render graphics and process visual information.

- **Overall responsiveness:** How quickly the system responds to user input and executes commands.

3.System Functionality

System functionality refers to the ability of a computer system to perform its intended tasks and functions correctly. This includes:

- **Feature completeness:** Ensuring that all advertised features and functions are present and operational.
- **Error handling:** The system's ability to handle errors and unexpected situations gracefully.
- **Stability:** The system's ability to run without crashing or freezing.
- **User experience:** How easy and intuitive the system is to use.
- **Security:** The system's ability to protect against security threats and vulnerabilities.

In essence, system compatibility ensures that the components work together, system performance determines how efficiently it works, and system functionality ensures that it works as intended.

Practical Activity 3.4.2: Performing computer system testing

Task:

1: Read the key reading 3.4.2

2: Referring to the key reading 3.4.2 you are requested to go in computer lab to perform computer system testing.

3: Present your work to the trainer and whole class.

4: In addition, ask questions where necessary.

Key readings 3.4.2: Practical Activity 3.4.2: Performing computer system testing

Performing computer system testing involves a systematic approach to ensure that the system meets its requirements and functions as intended.

Here are the general steps for conducting computer system testing:

1. Planning the Testing Process

Define Objectives: Determine what you want to achieve with the testing (e.g., validating functionality, ensuring performance).

Identify Scope: Specify the components of the system that will be tested (hardware, software, interfaces).

Create a Test Plan: Outline the testing strategy, resources needed, timelines, and responsibilities.

2. Requirements Analysis

Gather Requirements: Collect functional and non-functional requirements from stakeholders.

Review Requirements: Ensure that the requirements are clear, complete, and testable.

3.Design Test Cases

Develop Test Scenarios: Create high-level scenarios based on the requirements.

Write Detailed Test Cases: For each scenario, write detailed test cases that outline the steps, expected results, and acceptance criteria.

4.Set Up the Testing Environment

Prepare Hardware and Software: Ensure that the necessary hardware, software, and network configurations are in place.

Install the System: Set up the system to be tested, including any required dependencies.

5. Execute Test Cases

Perform Testing: Run the test cases according to the plan, documenting the results.

Record Defects: Log any issues or defects encountered during testing, including steps to reproduce and severity.

6. Verify and Validate

Confirm Fixes: If defects were found, ensure they are addressed and retest the affected areas.

Conduct Regression Testing: Verify that new changes have not adversely affected existing functionality.

7. Performance Testing

Assess Performance Metrics: Conduct tests to measure response times, load handling, and resource utilization.

Analyze Results: Compare performance against established benchmarks and identify any bottlenecks.

8.User Acceptance Testing (UAT)

Involve End Users: Have actual users test the system to validate that it meets their needs and expectations.

Collect Feedback: Gather insights from users and make necessary adjustments.

9. Final Review and Sign-Off

Review Results with Stakeholders: Present findings and get feedback from relevant parties.

- Performing computer system testing based on system compatibility, performance, and functionality involves distinct steps for each aspect.

Here's a breakdown of the testing steps tailored to each category:

1. **System Compatibility Testing**

Compatibility testing ensures that the software works across different environments, including operating systems, hardware configurations, and browsers.

Steps:

i. **Identify Compatibility Requirements**

- Gather information on supported operating systems, hardware configurations, and browser versions.
- Consult system requirements documentation.

ii. **Set Up Test Environments**

- Create multiple testing environments that reflect various configurations (e.g., different OS versions, browsers, devices).
- Include various screen resolutions and settings.

iii. **Design Compatibility Test Cases**

- Write test cases that focus on:
  - Installation and configuration.
  - Functionality across different environments.
  - User interface rendering and responsiveness.

iv. **Execute Compatibility Tests**

- Run the application in each environment.
- Validate installation processes, functionality, and UI behavior.

v. **Document Results and Issues**

- Record any compatibility issues encountered, including details about the environment where the issue occurred.
- Log defects with severity levels and steps to reproduce.

vi. **Retest and Verify**

- After fixes are made, retest the affected configurations.
- Ensure that compatibility is maintained across all required environments.

2. System Performance Testing

Performance testing evaluates the responsiveness, speed, scalability, and stability of the system under a specific workload.

Steps:

i. **Define Performance Metrics**

- Identify key performance indicators (KPIs) such as response time, throughput, resource utilization, and maximum user load.

ii. **Set Up Test Environment**

- Configure a performance testing environment that simulates production conditions.
- Use performance testing tools (e.g., JMeter, LoadRunner, or Gatling).

iii. **Design Performance Test Cases**

- Create test scenarios that simulate realistic user loads and transactions.
- Include tests for peak loads, stress testing, endurance testing, and load testing.

iv. **Execute Performance Tests**

- Run the designed test cases under varying loads to measure system performance.
- Monitor resource utilization (CPU, memory, disk I/O) during tests.

v. **Analyze Performance Results**

- Collect and analyze performance data to identify bottlenecks or degradation.
- Compare results against predefined benchmarks and KPIs.

vi. **Optimize and Retest**

- Identify areas for optimization based on analysis (e.g., code improvements, database tuning).
- Retest after making optimizations to verify improvements.

3. System Functionality Testing

Functionality testing focuses on verifying that the system operates according to specified requirements and behaves as expected.

Steps:

i. **Gather Functional Requirements**

- Review functional specifications, user stories, and acceptance criteria.
- Understand user scenarios and expected behavior.

ii. **Design Test Cases**

- Write detailed test cases for each functionality, including:
  - Positive and negative scenarios.
  - Edge cases.
  - User interactions.

iii. **Prepare Test Data**

- Create or gather test data needed for executing test cases.
- Ensure data covers a wide range of scenarios, including valid, invalid, and boundary inputs.

iv. **Set Up Testing Environment**

- Prepare a testing environment that closely resembles the production environment.

v. **Execute Functional Tests**

- Run the test cases systematically.
- Validate that each function operates as expected and produces the correct outputs.

vi. **Log Defects and Issues**

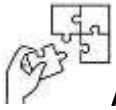
- Document any discrepancies between actual and expected results.
- Classify defects based on severity and impact.

vii. **Retest and Validate**

- After fixes are implemented, retest the affected functionalities.
- Confirm that all defects are resolved and that no new issues have arisen.

Points to Remember

- **Computer system testing** is a systematic process of evaluating a computer system to ensure that it meets specified requirements and performs as intended.
- **System compatibility** refers to the ability of different components within a computer system to work together seamlessly.
- **System functionality** refers to the ability of a computer system to perform its intended tasks and functions correctly.
- **Here are the general steps for conducting computer system testing:**
    1. Planning the Testing Process
    2. Requirements Analysis
    3. Design Test Cases
    4. Set Up the Testing Environment
    5. Execute Test Cases
    6. Verify and Validate
    7. Performance Testing
    8. 8.User Acceptance Testing (UAT)
    9. Final Review and Sign-Off



Application of learning 3.4

ABC Company, after assembling their new desktop computers as computer system refurbishment technician, you are Hired by ABC Company to perform a series of tests to ensure that all components are functioning properly.

Indicative content 3.5: Elaboration of System Report.

Duration: 4 hrs

Theoretical Activity 3.5.1: Description of computer system report.

Tasks:

1: Answer the following questions:

What do you understand about the following:

a. System report
b. Status before maintenance
c. Activity procedures
d. Status after maintenance
e. Conclusion and recommendation

2: Provide the answer for the asked questions and write them on flipchart /papers.

3: Present the findings/answers to the whole class

4: Ask questions where necessary.

5: For more clarification, read the key readings 3.5.1.

Key readings 3.5.1: Description of computer system report

1. **system report**

   A system report for a refurbished computer provides detailed information about its history, components, and condition.

2. **Status before maintenance**

   This section describes the initial state of the computer system before any maintenance activities were carried out. It provides a baseline for understanding the system's condition and any issues that necessitated maintenance. Key elements to include in this section are:

   System Information: Describe the system's specifications, including hardware components, operating system, and software.

   Problem Statement: Identify the issues, errors, or performance problems that prompted the need for maintenance. Include any error messages or symptoms observed by users.

   Maintenance Objectives: State the specific goals of the maintenance, such as resolving a particular issue, improving system performance, or ensuring security compliance.

3. **Activity procedures**

In this section, you outline the steps and procedures taken during the maintenance activities. This provides a detailed account of the work performed, helping to ensure transparency and accountability. Include the following information:

Maintenance Plan: Describe the plan and strategy for addressing the identified issues. This may include the sequence of actions, tools used, and timeframes.
Detailed Steps: Provide a step-by-step breakdown of the maintenance activities, including any diagnostics, repairs, software updates, or component replacements.
Tools and Resources: List the tools, software, and resources used during maintenance, including any specialized diagnostic software or equipment.
Personnel: Identify the individuals or teams responsible for performing the maintenance and their roles.

4. **Status after maintenance**

This section highlights the results of the maintenance activities and how they have impacted the system's condition. It is important to compare the current status with the initial status before maintenance. Key elements to include are:

Post-Maintenance System Information: Describe the system's specifications after the maintenance, including any changes made to hardware, software, or configurations.
Problem Resolution: Report on the successful resolution of identified issues, error messages, or performance problems. If some issues were not resolved, provide an explanation and plans for further actions.
System Performance:
Assess and report on any improvements in system performance, stability, or reliability achieved through the maintenance activities.
Security and Compliance: Confirm that any security vulnerabilities or non-compliance issues have been addressed and the system is now in compliance with relevant standards.

5. **Conclusion and recommendation**

In this final section, you provide an overall assessment of the maintenance activities and offer recommendations for the future.
This section helps stakeholders understand the impact of the maintenance and what steps should be taken next. Include the following:
Conclusion: Summarize the main findings of the report, emphasizing whether the maintenance objectives were achieved and any notable changes in the system's status.

Recommendations: Offer recommendations for ongoing system maintenance, potential improvements, or further actions.
This may include suggestions for regular system checks, preventative measures, or future upgrades.
Lessons Learned: Share any lessons learned during the maintenance process that could be applied to future maintenance activities or similar situations.

Practical Activity 3.5.2: Elaborating system report

Task:

1: Read the key reading 3.5.2
2: Referring to the key reading 3.5.2 you are requested to elaborate the system report.
3: Present your work to the trainer and whole class.
4: In addition, ask questions where necessary.

Key readings 3.5.2: Elaborating system report

Developing a computer system report involves a structured approach to gather, analyze, and present information about the system's performance, functionality, and status.

Here are the steps to create an effective computer system report:

1.Define the Purpose and Scope

Identify Objectives: Determine the primary purpose of the report (e.g., performance evaluation, pre-maintenance assessment).

Specify Scope: Define what aspects of the system will be covered (hardware, software, performance metrics, etc.).

2.Gather Information

Collect Data: Gather relevant data on system performance, functionality, and issues from various sources, such as:

System monitoring tools
User feedback
Previous reports
Logs and performance metrics

Conduct Interviews: If necessary, interview stakeholders, users, or technical staff to gather qualitative insights.

3. Analyze the Resolutions

Evaluate Effectiveness: Analyze the effectiveness of the solutions implemented. Did they resolve the issues completely? Are there any lingering effects?

Identify Patterns: Look for common themes or patterns in the issues resolved, which can help inform future maintenance or upgrades.

4.Organize the Report Structure

Create an Outline: Develop a clear outline for the report, including sections such as:

- Executive Summary
- Overview of Issues Encountered
- Resolution Process
- Performance Metrics Before and After Resolution
- Current System Status
- Recommendations for Future Improvements
- Conclusion

Determine Formatting: Decide on formatting elements such as headings, bullet points, and tables for clarity.

5.Draft the Report

Write Each Section: Begin drafting the report based on the outline, ensuring that each section is clear and concise.

Use Visuals: Incorporate charts, graphs, and tables where appropriate to present data visually and enhance understanding.

6. Review and Revise

Proofread: Check for spelling and grammatical errors, as well as clarity and coherence.

Make Revisions: Incorporate feedback and make necessary adjustments to improve the report.

7.Finalize the Report

Prepare the Final Version: Format the report according to organizational standards, ensuring consistency in font, style, and layout.

Include Appendices: Attach any additional supporting documents, logs, or detailed data as appendices.

Here is example of computer system report:

Date of Report: [Insert Date]

Time of Report: [Insert Time]

Reported by: [Your Name/IT Technician Name]

1. Overview of Issues

Provide a brief description of the issues encountered with the system.

- **System Affected:** [e.g., Laptop, Desktop, Server]
- **Operating System:** [e.g., Windows 10, macOS 11, Linux Ubuntu 20.04]
- **Primary Issues:**
  - [Issue 1]
  - [Issue 2]

- [Issue 3]

2. Issue Diagnosis and Troubleshooting

Summarize the steps taken to identify and diagnose the issues. Include any diagnostic tools or tests performed.

- **Initial Symptoms:**
- [e.g., Slow boot time, frequent crashes, application freezing]
- **Diagnosis Steps:**
- Ran [Diagnostic Tool] to analyze hardware/software issues.
- Checked system logs for error messages. Relevant logs:
  - [Error Log 1]
  - [Error Log 2]
- **Identified Root Causes:**
- [Cause 1: e.g., Outdated drivers]
- [Cause 2: e.g., Corrupted files in OS]
- [Cause 3: e.g., Malware infection]

3. Resolution Steps

List the actions taken to resolve the identified issues. Include details about updates, reconfigurations, or replacements.

- **Action 1:** [e.g., Updated graphics driver to version X.XX.]
- **Action 2:** [e.g., Reinstalled OS after backup of data.]
- **Action 3:** [e.g., Removed malware using XYZ software.]
- **Action 4:** [e.g., Increased virtual memory allocation.]

4. Post-Resolution Testing

Summarize the tests performed to confirm the resolution was successful.

- **Test 1:** [e.g., Rebooted the system and confirmed boot time was reduced to 30 seconds.]
- **Test 2:** [e.g., Ran stress test on CPU; no overheating observed after 30 minutes.]
- **Test 3:** [e.g., No further crashes after opening multiple applications simultaneously.]

5. Preventative Measures

Outline any measures implemented to prevent future issues.

- **Measure 1:** [e.g., Set up automatic OS updates.]
- **Measure 2:** [e.g., Installed a new antivirus program with regular scans scheduled.]
- **Measure 3:** [e.g., Added extra cooling to prevent hardware overheating.]

6. Final System Status

Provide a summary of the system's current performance after resolution.

- **System Health:** [e.g., Operating normally]
- **Current Performance:** [e.g., CPU utilization reduced, memory usage stable]
- **No further issues detected after:** [Monitoring duration, e.g., 2 hours of testing]

7. Recommendations (Optional)

Suggest any additional changes or upgrades that could improve system performance or stability in the future.

- **Recommendation 1:** [e.g., Upgrade SSD for faster boot times.]
- **Recommendation 2:** [e.g., Add more RAM to improve multitasking.]

8. User Feedback

Record any feedback received from the system user (if applicable).

Report Conclusion

The system is now fully operational after resolving the aforementioned issues. Continuous monitoring is recommended for the next [time frame] to ensure stability.

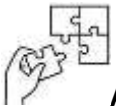
Technician **Signature:** _____

Date: _____

Points to Remember

- A system report is a comprehensive document that provides detailed information about a system, including its configuration, components, and performance. It is often used to document the status of a system before and after maintenance or troubleshooting procedures.
- Status before Maintenance this refers to the condition of the system prior to any maintenance or repair work. It includes a description of the problem or issue being addressed, any error messages or abnormal behavior, and the system's performance at the time.
- Activity Procedures these are the steps taken to address the problem or issue. They may involve hardware replacements, software updates, configuration changes, or other troubleshooting techniques.
- Status after Maintenance this describes the condition of the system after the maintenance or repair work has been completed. It includes information on whether the problem has been resolved, any improvements in system performance, and any remaining issues.
- Conclusion and Recommendation this section summarizes the overall outcome of the maintenance or repair work. It may include a statement of whether the problem was successfully resolved, any lessons learned from the experience, and recommendations for preventing similar issues in the future.
- Here are the steps to create an effective computer system report:
    1. Define the Purpose and Scope
    2. Gather Information
    3. Analyze the Resolutions

4. Organize the Report Structure
5. Draft the Report
6. Review and Revise
7. Finalize the Report



Application of learning 3.5.

You are a computer technician working in AZ Company, you are going to pass year in the mission outside the country and you finish to resolve the problem arises in the computer system, then you are requested to elaborate system report after resolving the issue successfully that might help other in your absence if the same issue arise.

Learning outcome 3 end assessment

Theoretical assessment

I. Select the right answer

Q1. What is computer system transformation?

A. The process of changing the physical appearance of a computer
B. The act of upgrading a computer's hardware components
C. The process of modifying a computer's software to improve its functionality.
D. The evolution of computer systems over time, encompassing hardware, software, and applications

Q2. Why do computer systems undergo transformation?

A. To make them look more aesthetically pleasing
B. To increase their processing power and efficiency
C. To reduce their cost
D. To make them obsolete

Q3. What technological advancement has had the most profound impact on computer system transformation?

A. The invention of the transistor
B. The development of the internet
C. The creation of the first personal computer
D. The discovery of electricity

Q4. Which of the following is not a safety precaution when assembling a computer?

A. Wearing anti-static wristbands.
B. Using a grounded outlet.
C. Discharging static electricity by touching a metal object
D. Working on a carpeted floor

Q5. Before installing components, you should**:**

A. Clean them with a damp cloth
B. Inspect them for damage
C. Apply thermal paste to the processor
D. All of the above

Q6. If your system is not booting up, you should:

A. Check the power supply connections
B. Reseat the RAM modules
C. Inspect the motherboard for damage

D. All of the above

Q7. What is the primary purpose of documenting the system's status before maintenance?

A. To identify potential issues or risks
B. To evaluate the effectiveness of maintenance activities
C. To provide a baseline for comparison after maintenance
D. To document the system's configuration changes

Q8. Which of the following elements should be included in the "Status Before Maintenance" section of a system report?

A. System performance metrics
B. Maintenance history
C. Future maintenance plans
D. All of the above

Q9. What is the importance of documenting the activity procedures followed during maintenance?

A. To ensure consistency and reproducibility
B. To track the time spent on maintenance tasks
C. To evaluate the effectiveness of maintenance personnel
D. To document the system's configuration changes

Q10. Which of the following should be included in the "Activity Procedures" section of a system report?

A. A detailed step-by-step guide
B. A list of tools and equipment used
C. The names of maintenance personnel involved
D. All of the above

Q11. What is the purpose of documenting the system's status after maintenance?

A. To identify potential issues or risks
B. To evaluate the effectiveness of maintenance activities
C. To provide a baseline for comparison before maintenance
D. To document the system's configuration changes

Q12. Which of the following elements should be included in the "Status After Maintenance" section of a system report?

A. System performance metrics
B. Maintenance history
C. Future maintenance plans
D. All of the above

Q13. What is the primary goal of the "Conclusion and Recommendation" section of a system report?

A. To summarize the key findings and provide actionable recommendations
B. To document the system's configuration changes
C. To evaluate the effectiveness of maintenance personnel
D. To track the time spent on maintenance tasks

Q14. Which of the following elements should be included in the "Conclusion and Recommendation" section of a system report?

A. An assessment of the maintenance activities' success
B. Suggestions for future improvements
C. A summary of any issues encountered
D. All of the above

II. Read the following statement and respond by **YES** if it is correct or **No** if not

i. Virtualization is a hardware-based technique for transforming computer systems.
ii. Firmware updates are a hybrid technique that involves both hardware and software components.
iii. Hardware upgrades, such as replacing a CPU or RAM, are a software-based technique for transforming computer systems.
iv. Networking and connectivity techniques, like upgrading network infrastructure or implementing new protocols, can significantly impact computer system performance.
v. Hybrid techniques combine elements of software-based and hardware-based transformations to achieve optimal results.

III. Complete sentences using computer system transformation techniques: by using **Virtualization**, **Networking** and **connectivity techniques**, **improving productivity** and **communication**, **optimizing resource utilization.**

A. ……. enables multiple operating systems to run simultaneously on a single physical server, …….
B. ……facilitate efficient data transfer and collaboration……

IV. Matching Computer System Testing with the definition

I.

Term	Definition	answer
1.Software-based Transformation	A) Combining software and hardware modifications to achieve desired changes.	1…….
2.Hardware-based Transformation	B) Enhancing the system's communication and interoperability with other systems.	2…….
3.Networking and Connectivity	C) Altering the system's capabilities by adding or replacing hardware components..	3…….
4. Hybrid Transformation	D)Modifying the system's behavior through software changes.	4……..

i. Matching Computer System Testing with the definition.

Term	Definition	answer
1. System Compatibility	A)The ability of hardware and software components to work together seamlessly.	1…….
2. System Performance	B)The speed and responsiveness of the system.	2…….
3.System Functionality	C)The ability of the system to perform its intended functions reliably and efficiently.	3…….
4.System Testing	D)The process of verifying that the system meets specified requirements.	4……..

Practical assessment

ABC Company has been experiencing performance issues with their existing computer system. The system is outdated and struggling to handle the increasing workload system. To address these challenges, ABC Company is requesting you to transform their computer system.

END

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