



## Basic Home/Office

# Electrical/Electronic Equipment

## Servicing Level II

**Module Title: - Implementing Maintenance  
Procedures**

**LG Code: EEL HOS2 M 06 (LO1-4) LG (20-23)**

**TTLM Code: EEL HOS2 M 06 1220 V1**

**December 2020  
Bishoftu, Ethiopia**



<b>LG #20</b>	<b>LO1:- Determine best practices for electrical /electronic Equipment maintenance</b>
<b>Instruction Sheet</b>	

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Future acquisitions of equipment and spare parts
- Vender documentation of best practices in equipment and software maintenance
- Requirements in equipment maintenance
- Documenting maintenance Procedures

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Future acquisitions of equipment and spare parts
- Vender documentation of best practices in equipment and software maintenance
- Requirements in equipment maintenance
- Document maintenance Procedures

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number.
3. Read the information written in the information “Sheet ----, Sheet ---, and Sheet --”.
4. Accomplish the information “Sheet ---, Sheet ----, in page \_\_\_\_\_”.
5. Try to answer self-check, you can ask your trainer for correction. If you finished answering the Self-check, take correction or explanation from your trainer if it is not clear.
6. If you scored a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, discuss with your trainer for further instructions or go back to learning **operation sheet-----**.
7. Submit your accomplished Self-check. This will form part of your training portfolio.



8. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you Instructor for assistance if you have hard time understanding them.
9. Accomplish the “Self-check 2” in page [redacted].  
Ask from your teacher for correction (key answers) if any.
10. Read the information written in the “Information Sheets 3”. Try to understand what are being discussed and ask you teacher for assistance if you have hard time understanding them.
11. Accomplish the “Self-check -----” in page [redacted].
12. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (To get the key answer only after you finished answering the Self-check 3).
13. If you scored a satisfactory evaluation proceed to “Operation Sheet 1” in page [redacted], however, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
14. Read the “Operation Sheet 1” and try to understand the procedures discussed.



<b>Information Sheet #1</b>	<b>Future acquisitions of equipment and spare parts</b>
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### 1.1. Introduction

A computer is an electronic machine that is controlled by internally stored programs and that can perform operation without human intervention. A computer is able to process data, run calculation, store information and make decision based on pre-defined conditions, that receives data from input device, carries out arithmetic and logical processing (process data) based on set of instructions, stores processed data, and sends the processed data to an output device.

- ✓ The hardware component is the general term for physical machine items that carry out the activities capturing processing and storing data or information, or simply the physical equipment that goes together to make up a computer, it is the part that we see and touch
- ✓ Software is a set of instructions called a program that the operating system instructs the computer how to operate, it tells the computer what to do, when and how to do it.



Fig. 1 desktop computer

**Note that:** A computer is not an intelligent device. It is only capable of doing what it is told and also it is not suitable for judgment, subjective thought, evaluation, initiative, or comprehension



**Characteristics of Computers** the computer itself has only limited ability and, in the final analysis, actually performs only four basic opera

- ✓ **Speed** :-the computer was invented as a high-speed calculator. This has led to many scientific projects which were previously impossible. If we want tomorrow's weather forecast today, meteorologist can use the computer to perform the necessary calculations and analysis.
- ✓ **Storage** :- computer can store a vast amount of information in its storage location for future use which can be recalled at any time.
- ✓ **Logical decision**:- A computer is capable of comparing data, both numeric and non-numeric; depending on the results, it makes certain decisions. These decisions are logical decisions which help the computer in deciding its way of action.
- ✓ **Super Efficiency and Automation**:- Unlike human beings computers can work for hours and produce error free results. Computers process data with the help of instructions fed into them, that is it work automatically. Computers manipulate data according to the instructions and they never get tired.
- ✓ **Accuracy** :-The computer's accuracy is consistently high. Errors in the machinery can occur but, due to increased efficiency in error detecting techniques, this seldom leads to incorrect results.
- ✓ **Reliability**:- Computer output is generally very reliable, subject to the condition the input data entering the computer should be correct and the program of instructions should be reliable and correct.
- ✓ **Versatility** ;-Computers seem capable of performing almost any task, provided that the task can be reduced to a series of logical steps for e.g., a task such as preparing the payroll or controlling the flow of traffic can be broken down into a logical sequence of operations. Yet tions:
  - ✓ It exchanges information to the outside world via I/O devices.
  - ✓ It transfers data internally within the CPU.
  - ✓ It performs the basic arithmetical operations.
  - ✓ It performs operations of comparisons

**1.2. Computer equipment**:- computer equipment means all computers, software or other equipment that includes computing technology or embedded logic , mechanical and electrical equipment, hardware for distributed and mainframe computers and servers, data storage devices, network connectivity equipment, and peripheral components and systems.

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**1.2.1. A printer** is an output device that prints paper documents. This includes text documents, images, or a combination of both. A printer is an output device that prints paper documents. This includes text documents, images, or a combination of both.

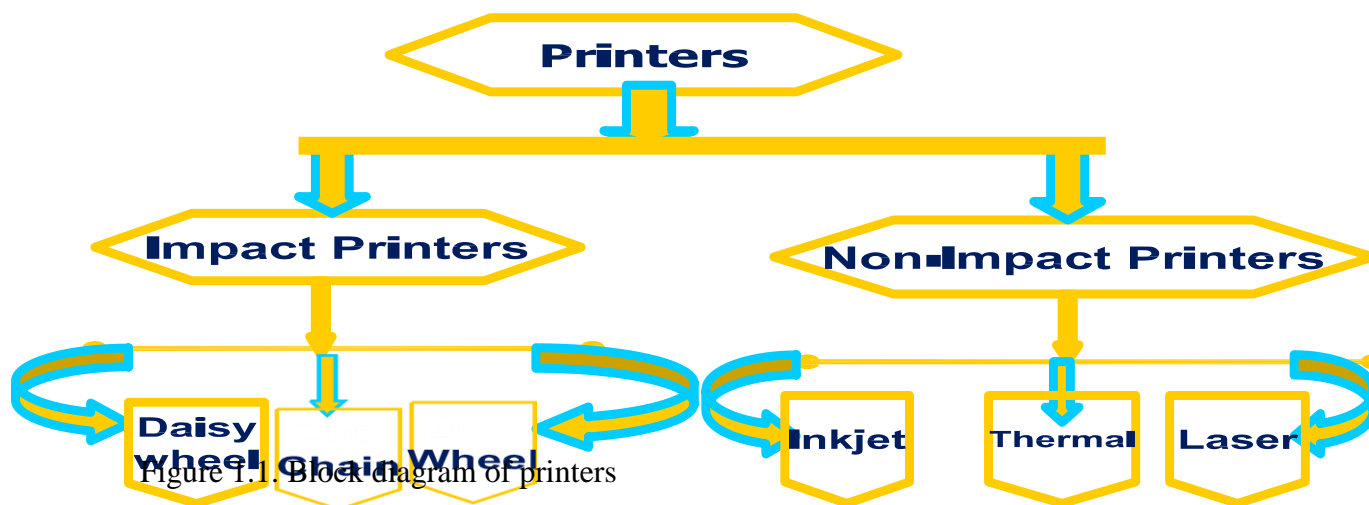


Figure 1.1. Block diagram of printers

Impact	Non-Impact
Produces text and images when tiny wire pins on print head strike the ink ribbon by physically <b>contacting the paper</b>	Produces text and graphics on paper <b>without actually striking the paper (no physical contact to paper)</b>
Uses <b>ink ribbon</b>	Uses <b>ink spray</b>
Print <b>quality lower</b> in some types	<b>High quality</b> of output, capable of printing fine and smooth details
<b>Low printing speed</b>	Reasonably <b>fast</b>
Generally <b>noise</b> because of the striking activity	<b>Low noise</b> because there is no striking mechanism
<b>Not commonly used</b> today	<b>Most commonly used</b> printer today

Table 1.1. Comparison of Impact non-Impact

**1.2.2. Dot matrix:-** refers to the process of placing dots to form an image. This is the cheapest and the most noisy printer and has a low print quality. Dot Matrix were 1st introduced by Centronics in 1970.



### Advantages of Dot Matrix Printers

- ✓ Cheaper than Most Printers
- ✓ Can Print Carbon Copies
- ✓ Indication of Ribbon Replacement

### Disadvantages of Dot Matrix Printers

- ✓ Output is Not High Resolution
- ✓ Pins Can Bend Easily
- ✓ Time-Consuming and Prone to Paper Jamming



Figure 1.2. Dot Matrix

**Inkjet printing;**- is a type of computer printing that recreates a digital image by propelling droplets of ink onto paper, plastic, or other substrates [1] Inkjet printers are the most commonly used type of printer,[2] and range from small inexpensive consumer models to expensive professional machines.

### Advantages

- ✓ Low cost
- ✓ High quality of output, capable of printing fine and smooth details
- ✓ Capable of printing in vivid color, good for printing pictures
- ✓ Easy to use
- ✓ Reasonably fast
- ✓ Quieter than dot matrix printer
- ✓ No warm up time



## Disadvantages

- ✓ Print head is less durable, prone to clogging and damage
- ✓ Expensive replacement ink cartridges
- ✓ Not good for high volume printing
- ✓ Printing speed is not as fast as laser printers
- ✓ Ink bleeding, ink carried sideways causing blurred effects on some papers
- ✓ Aqueous ink is sensitive to water, even a small drop of water can cause blurring
- ✓ Cannot use highlighter marker on inkjet printouts

**Laser printing** is an electrostatic digital printing process. It produces high-quality text and graphics (and moderate-quality photographs) by repeatedly passing a laser beam back and forth over a negatively charged cylinder called a "drum" to define a differentially charged image.



Figure 1.3. Laser printer

## Advantages

- ✓ Long life
- ✓ Fast printing speed
- ✓ Long-term non-printing effect will not change
- ✓ Suitable for mass printing, low cost
- ✓ Low quality requirements for paper

## Disadvantages

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- ✓ Color toner cartridge are expensive
- ✓ Toner is harmful to humans
- ✓ Will cause environmental pollution and release ozon

Modem:- is a device or program that enables a computer to transmit data over, for example, telephone or cable lines. Computer information is stored digitally, whereas information transmitted over telephone lines is transmitted in the form of analog waves.

There are two different types of modem: Ethernet modems that plug into the network card in the computer, and wireless modems that connect to a computer using a wireless LAN(WLAN)

- DSL Modem:- is configured through your telephone line a DSL modem is responsible for the connection between your PC and the telephone line that contains the Digital Subscriber Line service. Sometimes it is often referred to as a DSL transceiver and is implemented on the subscriber's end of the DSL connection.

On the provider's end is the DSL Access Multiplexer or DSLAM which receives the Internet connectivity request from the customer's DSL line which establishes an online connection.



Figure 1.4. DSL Modem

- Cable Modem:- A cable modem works similar to the DSL modem except that it creates communication between your PC and the cable television line by converting the signal for compatibility. The cable modem can either be internal or external for your PC to establish a



connection and in some cases it can be included with your TV cable receiver. For this reason, a cable modem cannot be used with a DSL connection and vice versa.



Figure 1.5.cable modem

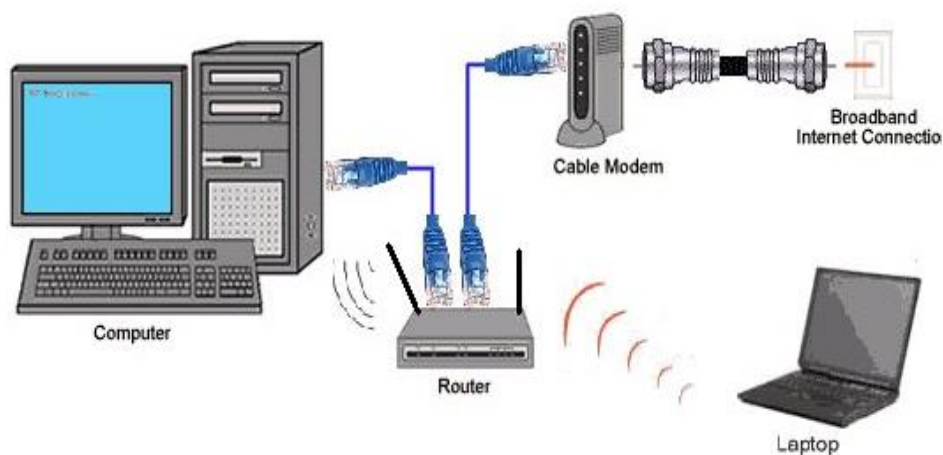


Figure 1.6. connection

Hard disk drive A hard drive is a secondary storage device that consists of one or more platters to which data is written using a magnetic head, all inside of an air-sealed casing. Internal hard disks reside in a drive bay, connect to the motherboard using an ATA, SCSI, or SATA cable, and are powered by a



connection to the PSU (power supply unit).hard drive consists of the following components head actuator, read write actuator arm, read/write head, spindle, and platter [2].

- Platters:- are the physical part of the hard drive responsible for storing data. Platters are circular, thin metal disks that have a diameter that's slightly smaller than the width of the device storage case. Disc platters resemble optical discs with thicker metal and no protective plastic coating.
- Spindle:- is the part of the hard drive that's responsible for spinning the platters so the device's read and write arm can access and save data. Hard drive platters are stacked on top of each other on top on the spindle. The platters have a hole in the center for placement on the spindle and are held in place on the spindle itself with platter clamps.
- Read and write arm:-is the part of the hard drive that reads data already stored on the platter and writes new data on the platter. The actuator arm includes the read and write heads that float just microns away from the platter that perform the actual read and write tasks.
- The actuator arm:- is connected to a part called the actuator that controls the positioning of the actuator arm relative to the disk platter. The actuator works with the spindle motor to position the actuator arm so it lines up with the platter to read and write data.

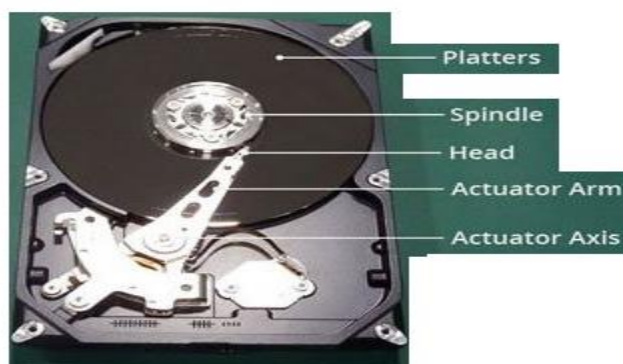


Figure 1.7. Hard disk drive

**Switch:-** is used in a wired network to connect to other devices using Ethernet cables. The switch allows each connected device to talk to the others. Wireless-only networks do not use switches because devices such as wireless routers and adapters communicate directly with one another [3].



## Type of switch

- LAN Switch(Local area network) or Active Hub
- Unmanaged Network Switch
- Managed Switch

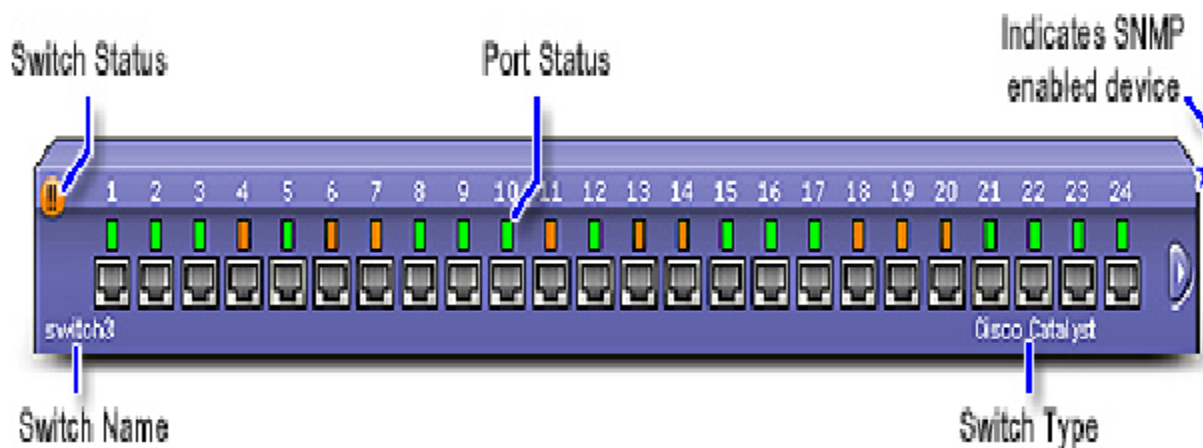


Figure 1.8. Switch

## Advantages of switches

- ✓ to connect dozens of devices.
- ✓ to keep traffic between two devices from getting in the way of your other devices on the same network.
- ✓ to control who has access to various parts of the network.
- ✓ Switches allow communication (within your network) that's even faster than the Internet.
- ✓ High-end switches can be tailored to your network needs with pluggable modules.

Router :- electronic device that sends a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet. It is connected to at least two usually two local area network (LANs) or wide area network (WANs). Routers are located at gateways wherein the places where two or more networks are connected.



## Router types

- Wireless routers:- provide Wi-Fi access to smart phones, laptops, and other devices with Wi-Fi network capabilities. Also, they may provide standard Ethernet routing for a small number of wired network devices.
- Brouter :-Short for bridge router, a router is a networking device that serves as both a bridge and a router.
- Core router:-A core router is a router in a computer network that routes data within a network, but not between networks.
- Edge router:- For information on an edge router, see our edge device definition page.
- Virtual router:-A virtual router is a backup router used in a VRRP setup.

Hub:-is the most basic networking device that connects multiple computers or other network devices together. Unlike a network switch or router, a network hub has no routing tables or intelligence on where to send information and broadcasts all network data across each connection. There are three type of hub Active, passive and intelligent.

- Active hub:- takes a larger role in Ethernet communications with the help of technology called store & forward.
- Passive hub:- is do very little to enhance the performance of the network. Neither, it helps in any way in the troubleshooting operations which have become an integral part of the networking operations in recent times.
- Intelligent hub:- is another form of hub that is increasingly being used. An advanced version that comprises the best of both active and passive hubs, it provides with the ability to manage the network from one central location. With the help of an intelligent hub, one can easily identify, diagnose problems and even come up with remedial solutions [4].

Peripheral device:- is a device that is connected to a computer but is not part of the core computer architecture. There are many different peripheral devices

- Input devices, such as a mouse and a keyboard
- Output devices, such as a monitor and a printer



- Storage devices, such as a hard drive or flash drive

### 1.3. Computer software

Software :-is a program that enables a computer to perform a specific task, as opposed to the physical components of the system (hardware) Computer software has to be "loaded" into the computer's storage (such as a hard drive and memory ).

Software is a generic term for organizing collections of computer data and instructions, often broken into two major categories: system software that provides the basic non-task-specific functions of the computer, and application software which is used by users to accomplish specific tasks.

Application software:-consists of programs designed to make users more productive and/or assist with personal tasks

- ✓ To make business activities more efficient
- ✓ To assist with graphics and multimedia projects
- ✓ To support home, personal, and educational tasks
- ✓ To facilitate communications

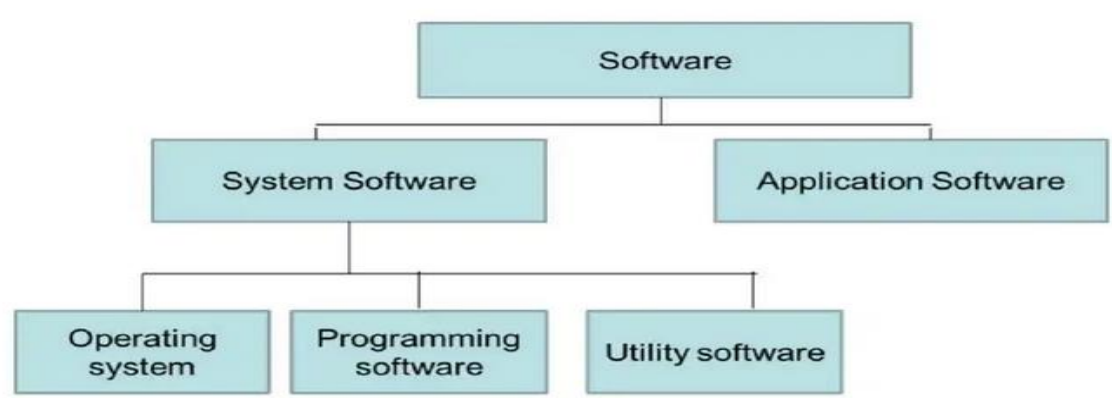


Figure 1.9. System Software

- ✓ System software is computer software designed to operate the computer hardware to provide basic functionality and to provide a platform for running application software.
- ✓ Refers to the operating system and all utility programs that manage computer resources at a low Level



- ✓ The boot program loads the operating system into the computer's main memory or random access memory (RAM).
- ✓ System software also includes system utilities, such as the disk defragmenter and System Restore.

Programming Software

- ✓ Programming software include tools in the form of programs or applications that software developers use to create, debug, maintain, or otherwise support other programs and applications.
- ✓ The term usually refers to relatively simple programs such as compilers, debuggers, interpreters, linkers, and text editors [5].

Application Software

- ✓ A program or group of programs designed for end users
- ✓ Allows end users to accomplish one or more specific (non-computer related) tasks.

<b>Self Check #1</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

**I. Multiple Choice Question (2 points each)**

Q1.The most widely used computer device is.

- |                       |                       |
|-----------------------|-----------------------|
| A. Solid state disks  | C. Internal hard disk |
| B. External hard disk | D. Mouse              |

2.\_\_\_\_\_ are software which is used to do particular task.

- |                     |         |
|---------------------|---------|
| A. Operating system | C. Data |
|---------------------|---------|



B. Program

D. Software

3. Which computer memory is used for storing programs and data currently being processed by the CPU ?

A. Internal memory

C. Non-volatile memory

B. Mass memory

D. PROM

4. A network of computers and other devices that is confined to a relatively small space is called?

A. Wide Area Network

C. Global Network

B. Local Area Network

D. Peer-to-Peer Network

5. \_\_\_\_\_ modem is responsible for the connection between your PC and the telephone line that contains the Digital Subscriber Line service.

A. LAN

C. Cable

B. DSL

D. None

**PART II** Give the short answer

1. Defined the following Terms

i. LAN \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ii. DSL Modem \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

iii. Cable Modem \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





iv. Hard disk drive

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v. Switch

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**Note: Satisfactory rating –10 points**

**Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**



<b>Information Sheet #2</b>	<b>Vender documentation of best practices in equipment and software maintenance</b>
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**2.1. A vendor** is the last entity in the chain that brands a product and sells it directly to end users or through a channel. A vendor may design and manufacture its own products, assemble complete systems from components produced by others, from the delivery of source materials from the supplier to the manufacturer, through to its eventual delivery to the end user , procure products from an original equipment or contract manufacturer [7].

**2.1.1. Importance of Vendor**

- ✓ Vendor’s reliability and financial stability
- ✓ Type of service offered after the sale
- ✓ Goods and services the vendor offers and keeps in stock
- ✓ Vendor’s willingness to demonstrate its products
- ✓ Vendor’s ability to repair hardware
- ✓ Vendor’s ability to modify software
- ✓ Availability of vendor-offered training
- ✓ Evaluation of vendor by independent organizations

**Documentation** :-in computer hardware and software product development, documentation is the information that describes the product to its users. It consists of the product technical manuals and online information (including online versions of the technical manuals and help facility descriptions). The term is also sometimes used to mean the source information about the product contained in design documents, detailed code comments, white papers, and blackboard session notes.

A functional specification is a formal document used to describe a product's intended capabilities, appearance, and interactions with users in detail for software developers. The functional specification is a kind of guideline and continuing reference point as the developers write the programming code.

- **Technical Documentation** :-used by computer operators to execute the program and by analysts and programmers in case there are problems with the program or if the program needs modification.



- **User Documentation** :-developed for the individuals who use the program. This type of documentation shows users, in easy-to-understand terms, how the program can and should be used.

## 2.2. The functional specification documentation process or typical series steps in developing a software product

- **Requirements:-** This is a formal statement of what the product planners informed by their knowledge of the marketplace and specific input from existing or potential customers believe is needed for a new product or a new version of an existing product. Requirements are usually expressed in terms of narrative statements and in a relatively general way [8].
- **Objectives:-** Objectives are written by product designers in response to the requirements. They describe in a more specific way what the product will look like. Objectives may describe architectures, protocols and standards to which the product will conform. Measurable objectives are those that set some criteria by which the end product can be judged. Measurability can be in terms of some index of customer satisfaction or in terms of capabilities and task times. Objectives must recognize time and resource constraints. The development schedule is often part or a corollary of the objectives.
- **Functional specification:-** The functional specification (called functional spec or just spec for short) is the formal response to the objectives. It describes all external user and programming interfaces that the product must support.
- **Design change requests:-** Throughout the development process, as the need for change to the functional specification is recognized, a formal change is described in a design change request.
- **Logic specification:-** The structure of the programming (for example, major groups of code modules that support a similar function), individual code modules and their relationships and the data parameters that they pass to each other may be described in a formal document called a logic specification. The logic specification describes internal interfaces and is for use only by the developers, testers and, later, to some extent, the programmers that service the product and provide code fixes to the field.
- **User documentation:-** In general, all of the preceding documents (except the logic specification) are used as source material for the technical manuals and online information, such as help pages, that are prepared for the product's users.



- **Test plan:-** Most development groups have a formal test plan that describes test cases that will exercise the programming that is written. Testing is done at the module (or unit) level, at the component level and at the system level in context with other products. This can be thought of as alpha testing. The plan may also allow for beta test. Some companies provide an early version of the product to a selected group of customers for testing in a "real world" situation.
- **The final product:-** Ideally, the final product is a complete implementation of the functional specification and design change requests, some of which may result from formal testing and beta testing.

### 2.3. Tools used for functional specifications documents

Documentation management :-lets users easily create templates and render documents. Functional requirements documents are often available as document templates. Spreadsheet software :-allows users to add columns as needed. In addition, it's not necessary to write perfect sentences. Users can just capture the key information a developer needs to build the correct product. Agile project management platform :-offers functionality for developers to capture details about requirements, use cases or user stories to incorporate into the designs of their products.

### Report Writing Format

Title Section :-This includes the name of the author(s) and the date of report preparation.

Summary :-There needs to be a summary of the major points, conclusions, and recommendations. It needs to be short as it is a general overview of the report. Some people will read the summary and only skim the report, so make sure you include all the relevant information. It would be best to write this last so you will include everything, even the points that might be added at the last minute.

Introduction:- The first page of the report needs to have an introduction. You will explain the problem and show the reader why the report is being made. You need to give a definition of terms if you did not include these in the title section, and explain how the details of the report are arranged.

Body :-This is the main section of the report. There needs to be several sections, with each having a subtitle. Information is usually arranged in order of importance with the most important information coming first.



Conclusion :-This is where everything comes together. Keep this section free of jargon as most people will read the Summary and Conclusion.

Recommendations :-This is what needs to be done. In plain English, explain your recommendations, putting them in order of priority.

Appendices :-This includes information that the experts in the field will read. It has all the technical details that support your conclusions.

<b>Self Check #2</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

**Part I. Give the short answer (5 points each)**

1. List and explain the main standard.
2. Explain functional specifications
3. Discuss user documentations
4. Discuss test plan

**Note: Satisfactory rating –10 points**

**Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**



<b>Information Sheet #3</b>	<b>Requirements are obtained from user in the area of equipment maintenance and reliability.</b>
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### 3.1. Maintenance Requirements

Safe and effective routine and preventive maintenance procedures should be planned during the design stage. These will affect layout since spacing distances and space allocation around most equipment items assume some degree of maintenance .

The plant must be made safe to maintain by having adequate valving for equipment isolation, vents, drains (and suitable collection points), washout facilities (using either water or solvents according to solubility) and possibly provision for gas purging.

### 3.2. Maintenance Equipment Reliability

The standard definition of reliability leaves much unsaid about the effects of equipment failure on businesses and people. You know when you have unreliable plant and equipment because people are angry that it fails so often. In companies with equipment reliability problems often repairing failures over and over again.

- ✓ It never ends, and you go home each day knowing there will be more troubles tomorrow.
- ✓ You also know when you have reliable equipment because it performs as its design intended without failures.
- ✓ The business likely makes good profits with low operating costs controlled to a narrow, known range.
- ✓ You have the time to do your work well.
- ✓ A place with reliable equipment is a happy and safe place.

Measuring equipment reliability is important if you want to improve it. Reliability is measured as the average time between failures, known as ‘Mean Time Between Failure’ (MTBF). One drawback with only measuring time is that there is no indication of the value of that level of reliability. If you do not know what reliability is worth, you may spend lots of money on small



improvements that have little impact on profitability. Or worst still, not spend enough money on highly profitable improvements [9].

Reliability measured only by expected time in service is a poor business indicator measure of improving reliability needs to show improving profitability

- Network

Network is exchange contact information with people who have interests in similar areas. An example of networking is sharing and acquiring information between different divisions of the same company to share information and solve business problems.

### 3.3. Organizational networks influence virtually everything organizations

Change: If networks are effective, they can adapt quickly to change.

Decision Making: The quality of people’s networks influences the quality of their decisions.

Leadership: Effective leaders tend to cultivate their networks in specific ways.

Culture: An organization’s culture is embedded in its networks. Networks can effectively resist or enable culture change.

Mergers & Acquisitions: If networks don’t integrate well after a merger or acquisition, the organizations won’t achieve desired synergies or cost savings.

Innovation: Bringing the people with the right skill sets together from across networks improves innovation.

<b>Self Check #3</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

#### Part I. Give the short answer (5 points each)

1. Explain Maintenance Equipment Reliability?



2. Explain Maintenances requirements?

3. List and Explain Organizational networks influence virtually everything organizations?

**Note: Satisfactory rating –8 points      Unsatisfactory - below 8 points**

You can ask your teacher for the copy of the correct answers

**Scored Points**





<b>Information Sheet #4</b>	<b>Documenting maintenance Procedures</b>
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**4.1. Introductions**

Maintenance procedures are written instructions when followed by the maintenance personnel will ensure that equipment operates as designed within safe operating limits.

Maintenance procedures and other work-related documents should identify preconditions and precautions, provide clear instructions for work to be done, and be used to ensure that maintenance is performed in accordance with the maintenance strategy, policies and programmers.

The procedures should normally be prepared in cooperation with the designers, the suppliers of plant and equipment, and the personnel conducting activities for quality assurance, radiation protection and technical support. They should be technically accurate, properly verified, validated, authorized and periodically reviewed.

**The following aspects should be considered with respect to Maintenance Procedures:**

- ✓ Human factors;
- ✓ Poorly skilled work force;
- ✓ Unconscious and conscious incompetence;
- ✓ Good maintainability principles;
- ✓ Knowledge of failure rate and maintainability; and
- ✓ Clear criteria for recognition of faults and marginal performance.

**4.2. Standard Maintenance Procedure**

The following steps are important when it comes to developing Standard Maintenance Procedure (SMPs) for jobs:

Have a pre-plan: Before you begin the large job, have the maintenance planner sit down with all of the personnel who were members of the work team the last time the job was done, or at least as many of them as are available.



**Photograph the job:-** The importance of this step is paramount. Even a well-written job plan can be misread or misunderstood. A photograph, however, speaks for itself. If you have the equipment and personnel, videotaping the procedure is even better. The supervisor is not a good choice for this role, because he/she needs to be supervising. If the reliability engineer is not available, perhaps the scheduler or the clerk can pitch in.

**Write it down:-** Write down the action step-by-step, beginning with the safe lockout of the machine. This individual should assume that he/she is writing the procedure for someone who is a total stranger to the plant and the machines—and that the written procedure will ensure that this imaginary person can successfully complete the job.

**Write out a complete parts list:-** This list should be as comprehensive as possible, down to the numbers and grades of the nuts, bolts and washers that are needed. Lead times for special-order or fabricated parts should be noted.

**Write out a complete supplies, tools and experts list:-** If special jigs or stands are made for the job, they should be noted on the SMP, including where they are stored. Have there been shortages of special welding rods or bottled gas? Jacks, cranes and special tools also should be noted. What about consultants or factory reps? If they were present last time, chances are they will be needed next time. Does an operator need to be present? Will it be desirable to have predictive maintenance personnel available to take readings for baselines after the job is completed?

**Include drawings and diagrams:-** Any tool, document or image that can help the technician as he/she is performing the job should be available.

<b>Self Check #4</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_



**Instruction:** Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

**I. Write the correct answer for the following question( 14points )**

1. Explain standard maintenances procedures (5 points)?
2. What aspects you should have to be considered with respect to Maintenance Procedures (6 points) ?
3. Explain how to documenting maintenances procedure (3points)?

**Note: Satisfactory rating –10 points**

**Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**

<b>Operation Sheet #1</b>	<b>Determine best practices for electrical /electronic Equipment maintenance</b>
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**Operation Title: - Documenting maintenance procedures**

**PURPOSE: -**

- The trainee’s will be able to keep the procedures.
- The trainee’s will be able to determine maintenances procedures.
- The trainee’s will be able to determine maintainance procedures for assembling and disassembling PC properly.

**Conditions or situations for operation: -** Have a clean workspace with all necessary tools and equipment.

**Equipment, Tools & Materials: -** Maintenance room, computer, CD, Maintenance tool kit, table, chair etc.

**Procedure: - 1. Disassembling the PC**

- ✓ Detach keyboard and mouse from the back of the computer
- ✓ Detach monitor



- ✓ Detach serial and parallel devices
- ✓ Detach network cables, speaker cables, Modem phone line
- ✓ Detach power cable.
- ✓ Remove system case
- ✓ Detach internal power cables from storage device
- ✓ Remove hard device and other storage devices.
- ✓ Remove adapter cards
- ✓ Remove power cables from system board
- ✓ Remove CPU
- ✓ Remove RAM & Remove cables from system board
- ✓ Remove screws holding system board in place
- ✓ Remove system board
- ✓ Document Disassembled PC procedures.

#### **Procedure: - 2. Reassembly the PC**

- ✓ Installing system board(Motherboard)
- ✓ Mounting the motherboard in the case
- ✓ Installing CPU, heat sink & the power lead for the CPU fan.
- ✓ Configure the motherboard jumper. Refer to the Mb manufacturer manual.
- ✓ Installing (Memory) RAM
- ✓ Connecting the power supply
- ✓ Installing the drives (HDD, Floppy & CD-Rom)
- ✓ Connecting I/O & other cables to the motherboard
- ✓ Connect the floppy, HDD & CD-ROM IDE/SATA cable to the motherboard.
- ✓ Installing Additional Expansion Cards.
- ✓ Document Reassembled PC procedures.

#### **Precautions:-**

- Take ESD precautions.
- Document everything (backup).
- Power all devices and disconnect them from the main power supply.

#### **Quality Criteria:-**

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- The trainee’s use safety for documents & components.
- The trainee’s documenting assembled & disassembled the pc with proper procedure.

<b>LAP TEST #1</b>	<b>Practical Demonstration</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** You are required to perform the following individually with the presence of your teacher.

1. How to document Assembled and disassembled products.
  2. From General safety precautions show the antistatic:
    - ✓ Electrostatic wrist strip
    - ✓ Antistatic mat
    - ✓ Antistatic box
- *Your teacher will evaluate your output either satisfactory or unsatisfactory. If Unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic*



<b>LG #21</b>	<b>Revise practices,</b>
<b>instruction sheet</b>	

This

learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Monitoring and reviewing Maintenance operation
- Problem service-level agreements
- Consulting with user
- Designing and implementing maintenance procedures.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Monitor and reviewing Maintenance operation
- Problem service-level agreements
- Consult with user
- Design and implementing maintenance procedures.

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number.
3. Read the information written in the information “Sheet again and again”
4. Accomplish the information “Sheet in all page
5. Try to answer self-check, you can ask your trainer for correction. If you finished answering the Self-check, take correction or explanation from your trainer if it is not clear.
6. If you scored a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, discuss with your trainer for further instructions or go back to learning operation sheet--
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you Instructor for assistance if you have hard time understanding them.



**9.** Accomplish the “Self-check 2” in page

Ask from your teacher for correction (key answers) if any.

**10.** Read the information written in the “Information sheet 3. Try to understand what are being discussed and ask you teacher for assistance if you have hard time understanding them.

**11.** Accomplish the “self-check” in page.

**12.** Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (To get the key answer only after you finished answering the Self-check 3).



<b>Information Sheet-1</b>	
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**1.1. Introduction**

Review by Maintenance and other qualified inspectors to ensure they contain adequate content and are in compliance with applicable regulations and safe practices. While Maintenance is encouraged to provide guidance and advice to Maintenance Organization in the preparation of their manuals, the development and production of an acceptable manual is solely the responsibility of the Maintenance Organization.

**1.2. Initial Review**

Before the initial certification of an applicant, a comprehensive review of the applicant's Maintenance Organization Manual and other user manuals must be conducted by the PMI and other qualified inspectors. In addition, those items in the Maintenance Organization Statement of Compliance that require the Maintenance Organization to develop a policy statement, system, method, or procedure, must be addressed.

**1.3. Review of Changes to Manuals**

After initial certification the PMI should review each revision or proposed revision to a manual. Inspectors should not limit this review to a strict consideration of the change itself but should also consider the impact of the change on the Maintenance Organization overall manual system and type of repairs.

**1.4. Periodic Review of Manuals**

Each PMI is responsible for developing a surveillance plan for the Maintenance Organization Manual system. At least one portion of the Maintenance Organization maintenance control manual should be reviewed annually, and the entire maintenance control manual should be reviewed over a period of 1 to 3 years (depending on the complexity of the Maintenance Organization).





<b>Self Check #1</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

**Part I Give short answer**

1. Explain periodic review of manual (5)?
2. Explain Review changes of manual (5)?
3. Explain Manual Review (5)?

**Note: Satisfactory rating – points                      Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**

**Note: Satisfactory rating –8 points                      Unsatisfactory - below 8 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**



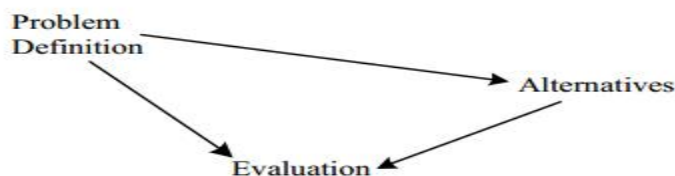
<b>Information 2 Sheet-2</b>	<b>Problem service-level agreements</b>
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## 2.1. Introductions

A problem can exist for some time without causing an incident but a single problem can also cause multiple different incidents. Likewise, a single incident may result from a combination of problems that would not separately cause an incident. Incidents may be resolved, meaning that service is restored, without discovering the problem responsible. However, without detecting the root source of an incident, there is no assurance that it will not recur.

### There are three basic methods to solve problems

- ✚ **The Good Idea Approach:** - You are somehow inspired and have a "good idea" which you attempt to develop and defend against all criticism. This approach often leads to failure since there is usually a closed mind to other ideas. Bad news is ignored until it is too late.
- ✚ **The Scientific Method:** - Begin by stating a theory or hypothesis. Collect data and analyze it to determine if the theory/hypothesis is true or false. Not really a relevant method for design problems since it involves the search for truth rather than the search for an answer.
- ✚ **The Systems Approach:** - Three separate activities: problem definition, development of alternatives, and evaluation.



Don't define problems as solutions; i.e. build a better mousetrap.  
Don't reject alternatives prematurely.  
Don't evaluate until problem and alternatives are clearly defined.

Figure 1.1. : System Approach



### ✚ Service Level Agreements (SLA)

A service-level agreement (SLA) defines the level of service you expect from a vendor, laying out the metrics by which service is measured, as well as remedies or penalties should agreed-on service levels not be achieved. It is a critical component of any technology vendor contract. This agreement is to ensure that the proper elements and commitments are in place to provide consistent electronics service support and delivery to the Customer(s) by the of Service Provider(s).

### Three types of options for structuring SLA

- ✚ Service-based
- ✚ Customer-based
- ✚ Multi-level or Hierarchical SLAs

## 2.2. Application Service Provider (ASP)

An Application Service Provider (ASP) is a third party organization that provides access to applications to multiple customers over network based on rental or lease contracts. It deploys and manages application software, system hardware, and networking at a centralized facility on behalf of the customers. An ASP may be a commercial entity, providing a paid service to customers or, conversely, a not-for-profit or government organization supporting end users

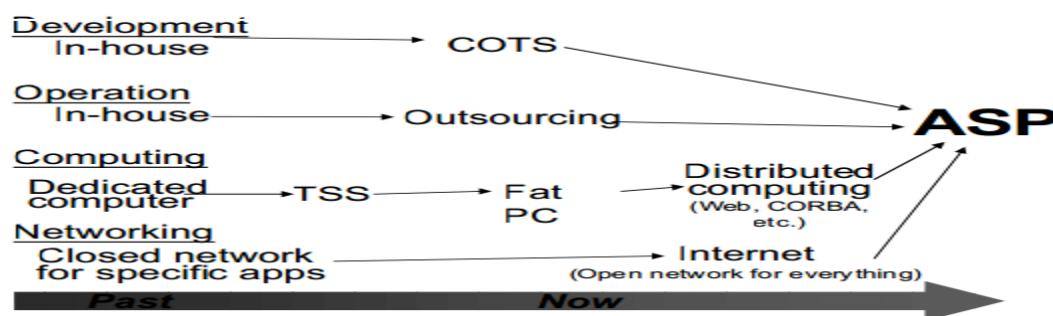


Figure 1.2. Application Service providers

### Pure ASPs focus on application services



- + Full service providers, example US internetworking ,Breakaway Solutions
- + Service aggregators, example. Corio, Future link

**Some application vendors are trying to become ASPs**

A vendor is the last entity in the chain that brands a product and sells it directly to end users or through a channel. A vendor may design and manufacture its own products, assemble complete systems from components produced by others, or procure products from an original equipment or contract manufacturer.

Vendors are a part of the supply chain: the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product, from the delivery of source materials from the supplier to the manufacturer, through to its eventual delivery to the end user.

**2.3. An Internet service provider (ISP)**

An Internet service provider (ISP) is a company that provides customers with Internet access. Data may be transmitted using several technologies, including dial-up, DSL, cable modem, wireless or dedicated high-speed interconnects.

ISPs also provide their customers with the ability to communicate with one another by providing Internet email accounts, usually with numerous email addresses at the customer’s discretion. Each ISP is different in that the company provides a different type of connectivity protocol and speed. Most ISPs are cable or DSL, but other options are available for small, rural areas. It's important to analyze your individual needs before deciding on an ISP.

**Dialup**

Although it's painfully slow, dialup access is still a necessity for small, rural areas. ISPs offer dialup access in these areas. A dialup ISP requires the user to have a modem for Internet access. The user dials a phone connection using a telephone number, connects to a remote server, and uses the telephone connection to browse websites.



### Cable

Cable is offered by the local cable company in the user's neighbourhood. Cable Internet access is available by connecting a cable router to the computer and connecting to a designated jack. Cable ISPs are usually faster, especially in areas where there is not much usage. Cable connections are shared by neighbours, which differs from DSL, so cable access speed is dependent on the amount of traffic from other neighbourhood users.

### Wi-Fi Access

Wi-Fi is wireless Internet access. It's used by laptops and offered freely by many hotels and coffee shops. Wi-Fi can also be installed in the home for people who have desktops and laptops networked. Wi-Fi is not as quick as DSL or Cable, but it's a more convenient ISP service.

<b>Self Check #2</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

#### Part I Give short answer

1. Explain An Internet service provider (ISP)?
2. Explain what it mean Pure ASPs focus on application services?
3. Explain with neat diagram of System Approach?

**Note: Satisfactory rating –10 points**

**Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**

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<b>Information Sheet-3</b>	<b>Consulting with user</b>
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### 3.1 Consulting With User

The term “consultant” can indeed take on many different forms. At bedrock, it refers to a professional who provides expert advice within a specific, specialized area (Oxford Dictionaries, 2018; Tordoir, 1995).

Consultants are commonly differentiated as being either “internal” or “external” consultants, depending on what function they serve or to whom they provide consulting advice. An internal consultant typically refers to someone operating within an organization. They may be consulted on their area of expertise by others within the same organization. An external consultant, on the other hand, typically refers to an externally employed expert who provides assistance or advice to an actor on a temporary basis, usually in exchange for a fee (Armbrüster, 2006; O’Mahoney and Markham, 2013). While the two categories are similar in as much that they both adhere to issues concerning confidentiality, risk project, project termination, etc., there are several practical differences between them as well. For instance, internal consultants are usually contracted in a rather informal manner as opposed to external consultants, and tend to be considerably cheaper to contract. They also tend to have a better knowledge about the organization from the outset than an external consultant. However, their strong tie to the organization carries the innate risk of them becoming overly cautious and/or apprehensive in taking or suggesting an action that would risk upsetting someone with the ability of influencing the internal consultant’s career in either direction. They may also lack certain skills in facilitating organizational change (Cummings and Worley, 2013; Burtonshaw-Gunn, 2010). External consultants, on the other hand, are often able to select their clients according to their own criteria and/or profile. They are generally looked upon as being more prestigious, which in turn elevates the organizations expectations for them to achieve their goal. This, by extension, enables the consultants to probe difficult issues and assess the organization in a more objective manner, devoid of any personal attachments and without fear of reprisals from the manager (Cummings and Worley, 2013; Scott and Barnes, 2011). Moreover, consulting firms range in size from sole proprietorships, consisting of a single consultant, and small businesses consisting of a small number of consultants, to mid- to large consulting firms. The latter of which may in some case be



multinational corporations. This type of consultant generally engages with multiple and changing clients, which are typically companies, non profit organizations or governments.

<b>Self Check #3</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

**Part I Give short answer**

1. Explain term Consultant with user with brief Example (10 points)?

**Note: Satisfactory rating –6 points      Unsatisfactory - below 6 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**



<b>Information Sheet-4</b>	<b>Designing and implementing maintenance procedures.</b>
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#### 4.1. Introductions

Introduction of a maintenance system is one of the best ways how to ensure effective implementation of maintenance activities in contemporary dynamic times. Under implementation of the said system, the factories are striving for best utilization of all physical, human and financial resources available to maintenance with the aim to maximize output effects. That means elimination of breakdowns occurring on machines and equipment, stabilization of performance and condition of machines and equipment, enhancing work safety, elimination of negative environmental impacts and other effects.

The system designed and implemented is part of the measures taken by the top management to increase the scope and effectiveness of PM (preventive maintenance) activities within the production facility [9].

#### 4.2. The goals of maintenance design and planning are the following:

- ✦ To develop a concept of maintenance and to supplement the systemic requirements with the maintenance requirements,
- ✦ To assess the proposed maintenance system effect as maintenance requirements and to optimize the maintenance concept, -
- ✦ To define maintenance requirements and maintenance plan,
- ✦ To specify the necessary resources,
- ✦ To reconfigure maintenance system to reflect changing manufacturing conditions.

Maintenance of electronic equipment can result in numerous benefits, including:

1. Reduced energy consumption.
2. Reduced resource use.
3. Increased recycling rates.
4. Keeping viable equipment out of the waste stream.
5. Reduced demand for new electronic products.
6. Maximizing product life and lifecycle environmental and cost benefits.





### 4.3. Steps of Maintenance procedure

To improve maintenance performance and reduce costs in the coming year, Here are some maintenance resolutions to consider improving your maintenance operations in the year to come.

#### 1. Plan

Develop a plan. Monthly, quarterly, and yearly process improvements and measurable goals will help keep a maintenance department moving forward. Perhaps you want to reduce your equipment downtime or reorganize all of your assets. Develop a plan and timetable, and execute it against defined benchmarks. Establishing goals for the year go hand-in-hand with developing the annual budget. Be sure to include new equipment needs, staff training, and any new initiative requirements to meet your goals.

#### 2. Update

If your company is still relying on spreadsheets or the even old-fashioned pen-and-paper methods to track assets and work orders, this resolution is especially important to you. The time has come streamline your maintenance operations through the use of a computerized maintenance management system (CMMS). There are many advantages to upgrading to a CMMS. These advantages include efficient work order management, preventive maintenance scheduling, access to real time maintenance information, ability to analyze reports on work orders, assets, labour usage, and parts and inventory for possible improvement.

#### 3. Maintain

All assets require a certain amount of upkeep. In order to preserve an asset, specific procedures must be put in place. A robust CMMS will help you schedule preventive maintenance and gather data to document and report on actual asset life.

Reduce downtime, conserve assets, and decrease repair costs. If any equipment was prematurely replaced last year or if there was an increase in breakdowns, a preventive maintenance strategy will guarantee operational improvements.

#### 4. Measure

Start by setting certain benchmarks in order to measure maintenance performance and determine results. Key Performance Indicators (KPI) allow for operational analysis so goals can be set and monitored.

<b>Self Check #4</b>	Written Test
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time Start: \_\_\_\_\_

Time Finish: \_\_\_\_\_

**Instruction:** Answer all the questions in the space provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

**II. Multiple Choice Question (2 points each)**

1. The process of storing the copy of your data in the safe place or a process of copy hard disk data in to other storage device?
 

A. Backup data	C. ROM
B. Hard disk	D. Explanation slot
  
2. A computer program that help you to protect your computer from virus?
 

A. Antivirus	C. Application software
B. Virus	D. Operational software
  
3. ----- defines the level of service you expect from a vendor, laying out the metrics by which service is measured, as well as remedies or penalties should agreed-on service levels not be achieved
 

A.SAL	B.SMN	C.SLA	D.none
-------	-------	-------	--------

**Part II. Give the short answer.**

1. Defined the following terms.
  - a. Dialup
  - b. DSL
  - c. Cable
  - d. Wi-Fi Access
  - e. Satellite

**Note: Satisfactory rating –5 points**

**Unsatisfactory - below 5 points**

You can ask your teacher for the copy of the correct answers.

**Scored Points**



<b>LG #22</b>	<b>Identify and analyze electrical /electronic system components</b>
<b>Instruction sheet</b>	

This

learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Determining and documenting warranty status of components
- Reviewing System Design and configuration documentation
- identifying Critical components

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Determining and documenting warranty status of components
- Reviewing System Design and configuration documentation
- identifying Critical components

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number.
3. Read the information written in the information “Sheet again and again”
4. Accomplish the information “Sheet in all page
5. Try to answer self-check, you can ask your trainer for correction. If you finished answering the Self-check, take correction or explanation from your trainer if it is not clear.
6. If you scored a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, discuss with your trainer for further instructions or go back to learning operation sheet--
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you Instructor for assistance if you have hard time understanding them.



**9.** Accomplish the “Self-check 2” in page

Ask from your teacher for correction (key answers) if any.

**10.** Read the information written in the “Information sheet 3. Try to understand what are being discussed and ask you teacher for assistance if you have hard time understanding them.

**11.** Accomplish the “self-check” in page.

**12.** Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (To get the key answer only after you finished answering the Self-check 3).



<b>Information sheet #1</b>	<b>Determining and documenting warranty status of components</b>
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1.1. Determine Warranty status of Components

The warranty period does not apply to accessories. 1-Year Limited Warranty is adopted for the power adaptor, remote control, cables, light module, light box, and lamps.

For surveillance products: The warranty will become invalid if any of the original parts are replaced. If a problem arises with your product, please send it back and have it fixed with all the original parts. If the product fails under normal usage conditions during the warranty period, AVer Information Inc. shall repair or replace the product without charge. According to this Limited Warranty, AVer Information Inc. reserves the right to

(i) repair the product using existing parts or

(ii) replace the product with the same product or one with equal value. In the event of a defect, these are your exclusive remedies. Whereas, if the returned product is not covered by warranty conditions, the customer shall pay for repair or replacement charges. Shipping costs of the returned product shall be covered by the customer and shipping costs of returning the repaired product shall be covered by AVer Information Inc. with the warranty period [11]. The customer shall notify AVer Information Inc. of the quality and serial number that comes with each unit per assigned RMA number. AVer Information Inc. will estimate the cost of repair if the product is out of warranty at the same time. The above charges are applicable to all malfunctions caused by abnormal use within the warranty period and malfunctions caused outside the warranty period. All charges listed are for reference only. AVer Information Inc. will issue a more accurate quote upon inspection of returned items. The quotation will be sent to customers in a RMA form via email. All repair work will only be done after the customer's confirmation. Customers must cover the delivery cost of returning the malfunction products and the delivery cost of returning the repaired products is covered by AVer Information Inc. during the warranty. Whereas all delivery costs of returning the products for repair are to be covered by the customer if not covered by the warranty.



## 1.2. Documenting warranty status of components

**Documentation Warranty:-** Contractor warrants that the written instructions regarding the use of Equipment, including those instructions in operation and maintenance manuals, shall conform to this Agreement and GECP as of the time such instructions are prepared. If any non-conformance with the Warranty specified in this Section 12.1C occurs or is discovered at any time prior to or during the Defect Correction Period, Contractor shall, at its sole expense, furnish Owner with corrected instructions. Documentation warranty is Contractor warrants that the written instructions regarding the use of Equipment, including those instructions in operation and maintenance manuals, shall conform to this Agreement and GECP as of the time such instructions are prepared. If any non-conformance with the Warranty specified in this Section 12.1C occurs or is discovered at any time prior to or during the Defect Correction Period, Contractor shall, at its sole expense, furnish Owner with corrected instructions.

### 1.2.1. WARRANTY AND CORRECTION OF WORK

warranty of work, contractor hereby warrant that:

1.The Equipment, and each component thereof, shall be new (unless otherwise specified in this Agreement) and of good quality;

2.The Work (including the Equipment) shall be in accordance with all of the requirements of this Agreement, including in accordance with GECP, Applicable Law and Applicable Codes and Standards; and

3.The Work (including the Equipment) shall be free from encumbrances to title, Contractor shall be fully responsible and liable to Owner for its Warranty and Corrective Work obligations and liability under this Agreement for all Work, including Work performed by its Subcontractors and Sub-subcontractors. Without limiting the foregoing, all warranties obtained by Contractor from Subcontractors shall run to the benefit of Contractor but shall permit Contractor, prior to assignment to Owner, the right (upon mutual agreement of the Parties), to authorize Owner to deal with Subcontractor on Contractor’s behalf. Such warranties, with duly executed instruments assigning the warranties shall be delivered to Owner concurrent with the end of the Defect Correction Period.

Exceptions to Warranty: The Warranty excludes remedy, and Contractor shall have no liability to Owner, for any damage or defect to the extent caused by:

- (i) improper repairs or alterations, misuse, neglect or accident by Owner;



(ii) operation, maintenance or use of the Project, Work or any component thereof in a manner not in compliance with a material requirement of operation and maintenance manuals delivered by Contractor to Owner;

(iii) normal wear and tear;

(iv) normal corrosion or

(v) an event of Force Major (but only, with respect to obligations).

### 1.2.2. Correction of Work Prior to Substantial Completion.

**A. General Rights.** All Work shall be subject to inspection by Owner at all reasonable times to determine whether the Work conforms to the requirements of this Agreement. Upon Owner giving reasonable prior notice, Contractor shall furnish Owner with access to all locations where Work is in progress on the Site and at the offices of Contractor and its Major Subcontractors. Owner shall be entitled to provide Contractor with written notice of any Work which Owner believes does not conform to the requirements of this Agreement. After Contractor becomes aware of a Defect in the Work prior to Substantial Completion, Contractor will provide Owner with a general plan that provides for Contractor to investigate and, if necessary, correct (whether by repair, replacement or otherwise) the Defect (having regard to the nature of the Defect, the Project Schedule, safety, insurance and any adverse impact on the operation of Subproject 1 or Subproject 2 after substantial completion of Subproject 1 or Subproject 2 (as applicable) under the Stage 1 EPC Agreement), which plan may need to be updated based upon the Contractor’s investigation or further development or implementation of the plan. Contractor will carry out and complete the necessary work at its own cost and expense in order to remedy the Defect prior to Substantial Completion, unless:

(i) Otherwise provided in the plan for earlier correction; or

(ii) Such Defect materially impacts the operation of Subproject. The cost of disassembling, dismantling or making safe finished Work for the purpose of inspection, and reassembling such portions (and any delay associated therewith) shall be borne by

(i) Contractor, if such Work is found not to conform with the requirements of this Agreement, and



(ii) By Owner, if such Work is found to conform with the requirements of this Agreement, and Contractor shall be entitled to a Change Order in such event.

B. Witness Points. Contractor shall provide Owner with a list of witness points for all Major Equipment no later than thirty (30) Days’ after execution of the relevant Subcontract and Owner shall notify Contractor which of the witness points it wishes its personnel to witness. Contractor shall provide Owner with at least fifteen (15) Days prior written notice of the actual scheduled date of each of the tests Owner has indicated it wishes to witness. Contractor shall cooperate with Owner if Owner elects to witness any additional tests, and Contractor acknowledges that Owner shall have the right to witness all tests being performed in connection with the Work. Notwithstanding Owner’s rights to witness tests, Owner shall not interrupt or interfere with any test or require changes while witnessing such tests; provided however, if Owner observes testing that, in Owner’s reasonable opinion, raises a safety concern or could cause damage to Major Equipment, then Owner has the right (but not the obligation) to notify Contractor and Contractor shall promptly respond after such notification to rectify any issues.

C. No Obligation to Inspect. Owner’s right to conduct inspections. Neither the exercise of Owner of any such right, nor any failure on the part of Owner to discover or reject Defective Work shall be construed to imply an acceptance of such Defective Work or a waiver of such Defect. In addition, Owner’s acceptance of any Work which is later determined to be Defective shall not in any way relieve Contractor from its obligations.

**1.2.3. Correction of Work After Substantial Completion.**

If, during the Defect Correction Period, any Work or component thereof is found to be Defective, and Owner provides written notice to Contractor within such Defect Correction Period regarding such Defect, Contractor shall, at its sole cost and expense, promptly correct (whether by repair, replacement or otherwise) such Defective Work, including all obligations in connection with such correction, such as in and out costs, storage, labor, Taxes, transportation and expediting costs and any other costs necessary to fully correct the Work (such correction of the Defective Work is hereby defined as the “Corrective Work”). Any such notice from Owner shall state with reasonable specificity the date of occurrence or observation of the alleged Defect and the reasons supporting Owner’s belief that Contractor is





responsible for performing Corrective Work. Owner shall provide Contractor with access to the Stage 2 Liquefaction Facility and/or the Stage 1 Liquefaction Facility sufficient to perform its Corrective Work, so long as such access does not unreasonably interfere with operation of the Stage 2 Liquefaction Facility or the Stage 1 Liquefaction Facility and subject to any reasonable security or safety requirements of Owner. In the event Contractor utilizes spare parts owned by Owner in the course of performing the Corrective Work, Contractor shall supply Owner free of charge with new spare parts equivalent in quality and quantity to all such spare parts used by Contractor as soon as possible following the utilization of such spare parts.

A. Owner Right to Perform Corrective Wor:- If Contractor fails to commence the Corrective Work during the Defect Correction Period within a reasonable period of time not to exceed ten (10) Business Days, or does not complete such Corrective Work promptly (and *provided that* Owner provides Contractor access to the Stage 2 Liquefaction Facility and/or the Stage 1 Liquefaction Facility in accordance with this . then Owner, as its sole and exclusive remedy for the Defect (except for its right to enforce the indemnification, defense and hold harmless obligations of Contractor pursuant upon providing prior written notice to Contractor, may perform such Corrective Work, and Contractor shall be liable to Owner for the reasonable costs incurred by Owner in connection with performing such Corrective Work, and shall pay Owner, within ten (10) Days after receipt of written notice from Owner, an amount equal to such costs (or, at Owner’s sole discretion, Owner may withhold or offset amounts owed to Contractor or collect on the Letter of Credit in accordance with the amount of such costs and expenses); provided, however, if Defective Work discovered during the Defect Correction Period presents an imminent threat to the safety or health of any Person and Owner knows of such Defective Work, Owner may perform such Corrective Work in order to correct such Defective Work without giving prior written notice to Contractor. In such event, Contractor shall be liable to Owner for the reasonable costs incurred by Owner in connection with performing such Corrective Work, and shall pay Owner, after receipt of written notice from Owner, an amount equal to such costs (or, at Owner’s sole discretion, Owner may withhold or offset amounts owed to Contractor or collect on the Letter of Credit in accordance with in the amount of such costs). To the extent any Corrective Work is performed by or on behalf of Owner, Contractor’s obligations with respect to such Defective Work that is corrected by or on behalf of Owner shall be relieved, with the exception of Contractor’s obligation to pay Owner the reasonable costs incurred by Owner in connection with performing such Corrective Work.



B. Extended Defect Correction Period for Corrective Work: With respect to any Corrective Work performed by Contractor, the Defect Correction Period for such Corrective Work shall be extended for an additional one (1) year from the date of the completion of such Corrective Work; provided, however, in no event shall the Defect Correction Period for any Work (including Corrective Work) be less than the original Defect Correction Period or extend beyond thirty-six (36) Months after Contractor’s achievement of Substantial Completion.

C. Standards for Corrective Work: All Corrective Work shall be performed subject to the same terms and conditions under this Agreement as the original Work is required to be performed. In connection with the Corrective Work, any change to Equipment that would alter the requirements of this Agreement may be made only with prior written approval of Owner in accordance with Section 3.29.

D. Expiration of Defect Correction Period: Contractor shall not be liable to Owner for any Defective Work discovered after the expiration of the Defect Correction Period, except for any liability of Contractor pursuant to its indemnification, defense and hold harmless obligations under this Agreement.

1.2.4. Assign ability of Warranties. The Warranties made in this Agreement shall be for the benefit of Owner and its successors and permitted assigns and the respective successors and permitted assigns of any of them, and are fully transferable and assignable.

1.2.5. Waiver of Implied Warranties. The express warranties set forth in this Agreement (including Warranties) are exclusive and the Parties hereby disclaim, and Owner hereby waives any and all warranties implied under Applicable Law (including the governing law, including the implied warranty of merchantability and implied warranty of fitness for a particular purpose.

Self Check #1	Written Test
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time Start: \_\_\_\_\_

Time Finish: \_\_\_\_\_



Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

- I. Explain the following question
  1. Explain how to determine warranty status of components (4 points)
  2. Explain how to Documenting warranty status of components? (2 point)
  3. What is warranty? (5 points)
  4. What is guarantee? (1 point)
  5. Explain assignability of warranty?(5 points)

*Note:* Satisfactory rating –8.5 points                      Unsatisfactory - below 8.5 points

You can ask your teacher for the copy of the correct answers



<b>Information sheet #2</b>	<b>Reviewing System Design and Configuration Documentation</b>
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## 2.1. Reviewing System Design

### 2.1.1. Five Simple Steps for Truly Effective Design Reviews

#### 1. Enlist independent reviewers

The goal of building out the review team should be to field a group that can challenge and push the design further. I had a colleague explain it to me like this: "when you only include people who are familiar with the design, you don't get the advantage of fresh perspective and ignorance. The most dangerous phrase during a design review is "this is how we always do it." The review team should be able to question and push on the design." Asking your "work buddies" to review your work is an easy route, but it's not likely to produce the best designs. Even having a review team that is exclusively made up of people familiar with the project could lead to an echo chamber and group think. For the best review, create an independent review team of multiple discipline engineers with varying levels of experience. It's important to have a fresh set of eyes and folks that will approach a problem from potentially different angles.

#### 2. Stop the review if people are not prepared

One of the most memorable (and productive) design reviews of my career occurred a couple months after graduating and becoming an engineer. I was a junior engineer on the project and we were heading into CDR (critical design review). When the day came to review the circuit design my team had been working on tirelessly for months, we all gathered into the conference room waiting for the meeting to begin. A few minutes into the meeting, it became clear that a couple of our reviewers had not had a chance to fully review the technical content and design. Instead of bringing them up to speed, the chair of the design review (a senior engineer on the project) halted the meeting immediately, asked sternly why they had not completed their review prior to the



meeting, and then quickly cancelled the remaining design review until they were able to complete their review.

This experience had a lasting impact on my understanding of how to conduct a successful review. The meeting itself is not a time to actually review the design. It is a time to come with your redlines, questions, concerns, and comments.

In order to hold the best possible review, ruthlessly insist that everyone comes prepared and ready to jump into the difficult tasks of improving the design.

### 3. Check your feelings and emotions at the door

If a design review is conducted properly, no design decision is left unquestioned. For an engineer, our designs are a part of our identity. Like an artist and their paintings or a composer and their music, our designs represent us as engineers. So it stands to reason, a meeting where you're surrounded by your peers while they question every aspect of your work can be difficult if you're not in the right frame of mind.

It's important for both the designer and the review team to avoid emotionally charged comments and attacks.

That being said, if you're passionate about your work like most of us, it's natural for the conversations to get a little heated. The important thing to remember is that we are all on the same team and we are all seeking the same thing, to get the best design possible with as few defects as possible. So check your feelings at the door, bring an open mind and be prepared to answer the hard questions.

### 4. Take notes in real time (digitally)

These days almost everything of importance ends up in digital form. Yet for many of us who are engineers, we still live and die by our paper engineering notebook. I'm not advocating against



paper notebooks, I'm simply suggesting for this use case, taking notes digital will be faster, more complete, and will allow you to get actions assigned (and closed) more quickly.

If you are intimidated by taking effective meeting notes, you can use the follow-up email template below (Step 5) to help guide your note taking. If you have trouble running a review, taking notes, and discussing your design decisions, then ask a co-worker to be the scribe for the design review. This is a great task for engineering interns or recently minted engineers. It will take some of the pressure off your shoulders and help the junior engineer feel like they are contributing in an important way.

### 5. Follow up immediately

Now I know this may come as a surprise to most of us, but the majority of meetings are basically worthless. They could have just as well been an email and saved everyone invited precious time to be doing something more productive. Design reviews are one of those special exceptions that is actually worth pulling a bunch of high paid engineers into a room together.

## 2.2. Configuration Documentation

### Creating a Configuration Settings document

Use the Configuration Settings document to set up LDAP, mail, mail routing, and MIME on an HCL Domino® server. You can also use this document to edit settings in the NOTES.INI file. A Configuration Settings document can define settings for all of your Domino® servers in one HCL Notes® domain, for the servers in one specific group, or for one individual server.

#### About this task

The Configuration Settings document includes settings that affect both Notes® routing and SMTP routing. Each setting you designate in a Configuration Settings document applies to every server specified in that document.

Each setting applies to every server included in the Configuration Settings document. Therefore, you need multiple Configuration documents if you need different settings for specific servers. For example,



To specify additional restrictions for a server that is included in a group, create a separate Configuration Settings document for the specific server. For example, assume you have a Configuration Settings document for a group of servers or for all servers. The executives in your organization have their own mail server and require different settings. You will need to create a Configuration Settings document for the specific server. The document that is most specific (in terms of which servers it applies to) will take precedence.

Each server checks the Configuration Settings documents in the following order -- a document specific to the server, then a group document for any group the server is in, and then for the default document. If there are multiple Configuration documents for groups containing the same server, the results are undefined. For example, if Server A has a Configuration Settings document and is also listed in a Group Configuration document or an All Servers Configuration document, the only settings that the server will use are those listed in the Configuration Settings document specific to Server.

From this view, you can add, edit, or delete a Configuration Settings document. To view the Configuration Settings documents in the Domino® Directory on a different server, you can select the server name in the Use Directory on field. A Parameters column displays the list of parameters entered on the NOTES.INI tab of each document. The Administrators column lists the name of the administrator who most recently updated the list of parameters.

Self Check #1	Written Test
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time Start: \_\_\_\_\_

Time Finish: \_\_\_\_\_

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

I. Explain the following question

1. Explain how to Configure a document (4 points)

2. Explain The Procedure of Configure Document? (3 point)



3. Explain 5 steps of Design Review (10 points)

*Note:* Satisfactory rating –8.5 points      Unsatisfactory - below 8.5 points

You can ask your teacher for the copy of the correct answers





<b>Information sheet #3</b>	<b>Identifying Critical components</b>
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### 3.1. Identify Critical Components

#### 3.1.1. Common Hardware Problem and Trouble Shootings

Troubleshooting method: troubleshooting is the process of identifying and correcting problems. The best troubleshooting are usually people who have been exposed to most problems. They have seen difference type of problem and their solution therefore; if they run into a particular problem, they might see it before and can quickly addresses the problem.

Most of the solutions are quite simple. So you don't have to be a technical expert to work with your PC in good condition. If you want to be a good troubleshooter, just follow the procedure in this book.

#### 3.1.2. Starting point for trouble shooting

Every technical [computer user] has his or her own way to be a troubleshooter. Some people use their instincts while others need an advice from other people. But let us see a common troubleshooting method

##### Point 1. Gathering Information

Ask the customer the following question to define the problem.

- ✓ Can tell me something about the problem.
- ✓ What did you do to your computer lastly [before it stopped working?]
- ✓ How often does this happen? Have you installed new software? Have you delete some files?
- ✓ Have you added a new hardware device?
- ✓ Have you made any other change to your computer recently?

##### Point 2. Check the power and cable connection

- Check the power line
- Check the wall outlet power
- Check the power sockets
- Check the cable
- It is plugged in



- It is turned on
- Is the computer ready to accept command from the user?
- Open the case covers and reset chips and cable

Point 3. Check if the error is user's error

- Because the user cannot print
- Because the user cannot save the files
- Because the user cannot run application etc

If the user is wrong, show him/her how to use the computer.

Point 4. Restart the computer

This process is the "Cold Boot" (since the machine was off or cold when it started) A "warm boot" is the same excepts it occurs when the machine is rebooted using {Ctrl + Alt +Del}

NOTE:-Reboot can solve or show the problem. Rebooting doesn't work, try to power down the system completely and then power it up.

Point 5. Define if the problem is a hardware or software re related

- It is a startup problem
- It is windows problem
- It is a program problem
- It is a device problem

Startup problem: an error occurs before or during boot process

Windows problem: An error occurs with windows system itself

Program problem: An error occurs with a specific program

Device problem: An error occurs with a specific piece of hardware part.

Point 6. Find out the problem and solve it

- If the problem is hardware related, determine which component is failing and try to solve problem.
- Is the problem is software related; determine which is corrupted or missed and try to solve the problem



### 3.2. Replacement Method

When you troubleshoot, make one change at a time is my favorite troubleshooting method). If the change does not solve the problem, change it back to its original state before making another change.

For Example, you may have trouble on your monitor. If you can get another monitor, attach to your system and try it. If the other monitor works, you know that the problem is with your monitor. But if the other monitor does not work, change it back to its original state and try to find other possible causes.

#### Common hardware problem and their solution

1. Mouse
2. Keyboards
3. Power supply
4. Motherboard
5. Main memory
6. Hard disk
7. Sound card
8. Modem card
9. Monitors

#### Mouse problem and their solution

Problem: The mouse may hang up or may not move in the correct way d to dust. [Doesn't work properly]

#### Solution

- ✓ Clean the mouse [mechanical mouse]:
- ✓ Shutdown the PC
- ✓ Remove the mouse cable from its connection at the back of your PC.
- ✓ Turn the mouse upside –down and remove the securing screws from the mouse case
- ✓ Remove the mouse ball from the cavity
- ✓ Clean the cavity and the mouse ball with proper available materials.[use dry cloth]
- ✓ Look inside the mouse housing. You will see the two perpendicular bars. Use your finger nail to scrap along each bar, removing any dirt.
- ✓ Reconnect the cable to the computer
- ✓ Turn on the pc and see that if it is activated.

Problem: The new PS/2 or serial mouse doesn't work when plugged on the system running windows XP



### Solution

- ✓ Plug the new mouse firmly
- ✓ Restart the PC
- ✓ The new mouse will be active
- ✓ Else-use a replacement method

### Keyboard problem and solution

Problem:-While working on PC, something (liquid) spilled into the keyboard

### Solution

- ✓ Remove the keyboard cable from its connection at the back of the PC. Do not wait! You need to cut power to the device in order to avoid a possible short circuit
- ✓ Shutdown the PC using mouse
- ✓ Tip the keyboard upside down and drain out as much of the liquid as you can.
- ✓ Try to dry the inside part of the keyboard properly by using blow dryer or direct sunlight.
- ✓ Reconnect the keyboard cable to the computer.
- ✓ Power up the computer and manipulate the keyboard to assure proper functioning

Problem: Some keys on the keyboard doesn't work

### Solution

- ✓ For the current help Use on screen keyboard [win XP]
- ✓ Turn off the PC and remove the keyboard cable from its connection at the back of the PC
- ✓ Turn the keyboard upside –down and remove the securing screws properly
- ✓ Select the key that you want to remove. Just be careful not to damage the other key
- ✓ Clean or adjust the Site of the key properly
- ✓ If you remove multiple keys, be sure to return them to their proper seats.
- ✓ Make sure that the keyboard is dry while cleaning
- ✓ Reconnect the cable to the computer
- ✓ Boot up the pc and check that if activated

### CPU problem and trouble shooting

Problem:-Both the CPU and power supply but the system shows a black screen

### Solution

The CPU might be damaged. Use the replacement method

CPU problem possible cause:

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- Overheating
- Static discharge
- Bent or broken pens.

### 3.3. System Architecture and Configuration

#### Introduction to Single Chip Microcomputer

#### Basic Units of Microcomputer System

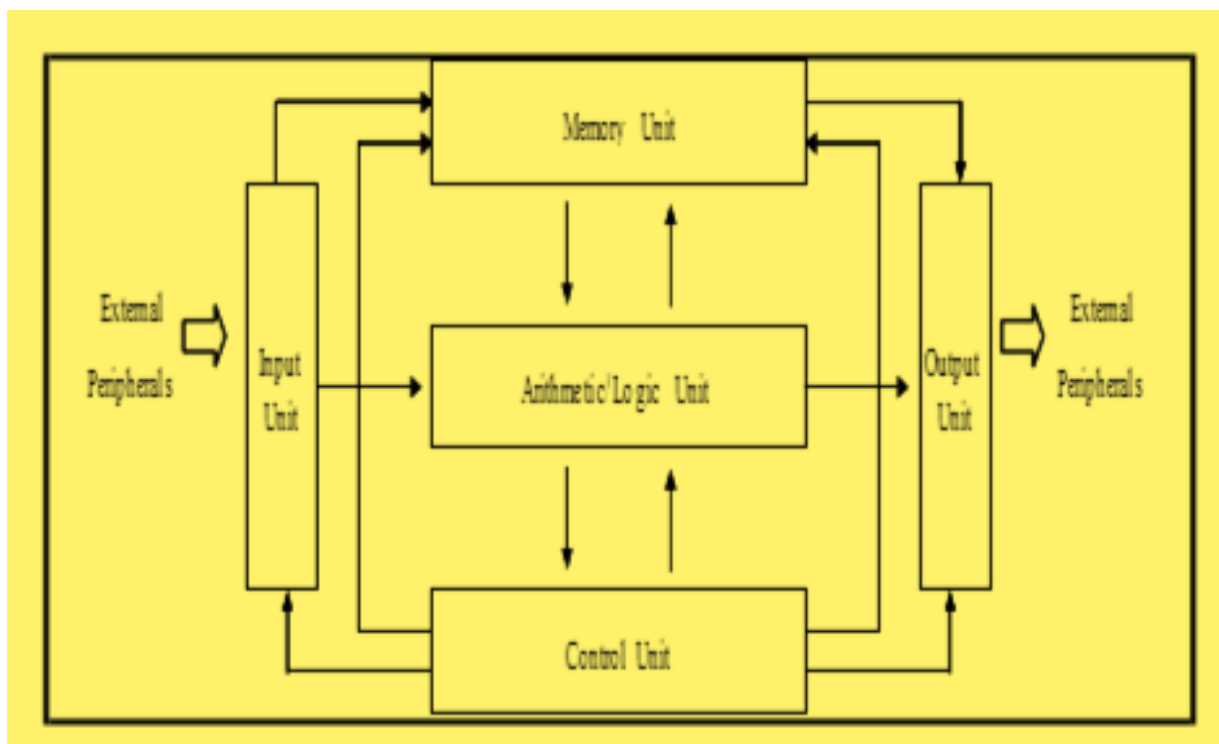


Fig 3.1 shows the five basic units of microcomputer system.

#### 1. Arithmetic Logic Unit (ALU)

The arithmetic and logical unit (ALU) performs arithmetic operations such as addition, subtraction, multiplication, and or division, and logical operation such as AND, OR, NOT and XOR needed to carry out the instructions.

#### 2. Control Unit (CU)

The control unit (CU) is responsible for fetching instructions from main memory and determining their type.



### 3. Memory Unit (MU)

The memory unit (MU) is used to store information such as number or character data. By store we mean that the memory has the ability to hold this information for processing or for outputting at a later time.

The memory unit is divided into primary storage memory and secondary storage memory. Typically, Primary storage memory is implemented with semiconductor memories: read-only memory (ROM) and random access read/write memory (RAM) integrated circuits. Secondary storage memory is used for long-term storage of information that is not currently being used such as disk and CD ROM.

#### Semiconductor Memories

##### Rom (Read-Only memory)

By using ROM, the information is made nonvolatile; that is, the information is not lost if power is turned off. ROMs can be divided into:

##### 1. Mask ROM

Mask ROMs cannot be changed or erased, internationally or otherwise. The data in a mask ROM are inserted during its manufacture, essentially by exposing a photosensitive material through a mask containing the desired bit pattern and then etching away the exposed or unexposed surface. The only way to change the program in a mask ROM is to replace the entire chip.

##### 2. PROM

The PROM (Programmable) is like a mask ROM, except that it can be programmed once in the field.

##### 3. EPROM

The EPROM (Erasable PROM) cannot only be field – programmed but also field erased. When the quartz window in an EPROM is expressed to storage ultraviolet light for 15-20 minutes, all the bits are sets to 1. If many changes are expected during the design cycle, EPROMs are far more economical than PROMs because they can be reused.

##### 4. EEPROM

The EEPROM (Electrically Erasable PROM) or E<sup>2</sup>PROM can be erased by applying pulses to it instead of requiring it to be put in a special chamber for exposure to ultraviolet light . The new type of



ROM called Flash memory is similar to EEPROM in configuration. Flash memory can be programmed on a circuit board by the use of ISP (In-System Programming).

RAM (Random access Memory)

By using RAM, the information is made volatile; that is, the information is lost if power is turned off.

RAMs come in two varieties: static and dynamic.

#### 1. SRAM

SRAMs are constructed internally using circuits similar to the basic D latch. These memories have the property that their contents are retained as long as the power is kept on.

#### 2. DRAM (Dynamic RAM)

DRAMs, in contrast, do not use latch – like circuits. Instead, a dynamic RAM is an array of tiny capacitors, each of which can be charged or discharged, allowing 0 and 1 to be stored. Because the electric charge tends to leak out, each bit in a dynamic RAM must be refreshed every few milliseconds to prevent the data from leaking away.

Because external logic must take care of the refreshing, dynamic RAMs require more complex interfacing than static ones, although in many applications this disadvantage is compensated for by their large capacities. Some dynamic RAMs have on-chip refresh logic, providing both high capacity and simple interfacing.

#### 4. Input unit (IU)

The input unit (IU) is used to input the information to be processed from external input device such as a card reader, keyboard, or switch.

#### 5. Output Unit (OU)

The output unit (OU) is used to output the processed results of computer to the external output devices such as a printer, monitor, 7- segment display, and LED.

The five units in Fig.3.1 can be simplified to three units as shown in Fig.3.2. The input/output unit, or usually just I/O unit, is a combination of input unit and output. The central processing unit (CPU) is formed by combining the ALU and CU together. The CPU is the brain of the microcomputer.

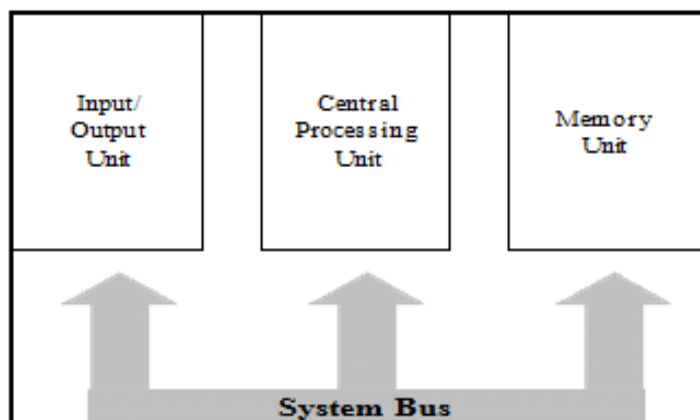


Fig. 3.2 Three basic units of microcomputer system

A bus is a collection of wires used to transmit signals in parallel. According to the purpose, the buses of a microcomputer can be divided into three types: address bus, data bus, and control bus. Three buses are shown are shown in Fig.3.3.

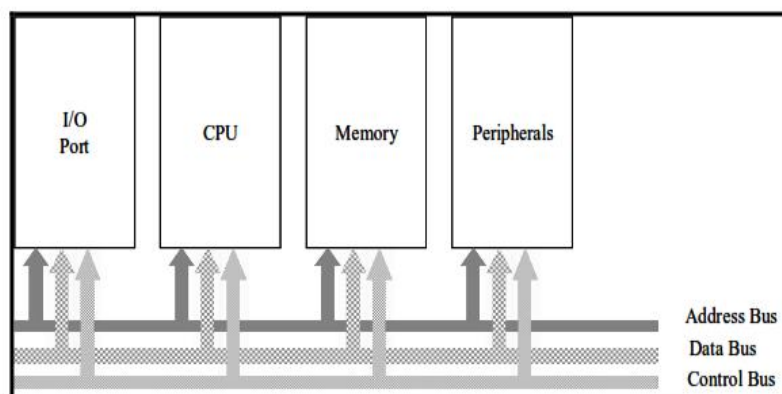


Fig. 3.3. Buses

#### 1. Address Bus

The unidirectional address bus transmits the address signals emitted from CPU to memory and I/O port.

#### 2. Data Bus

The signal on the bidirectional data bus is the data either from CPU to memory and I/O or from memory and I/O to CPU.

#### 3. Control Bus

The control bus is used to transmit the control signals such as read, write, and interrupt control signal.





### Single-Chip Microcomputer

Microcomputer control system such as air-conditioner, clothes washer-dryer, and security system, etc, are widely used in our everyday life. How to build up a microcomputer control system? The earlier multi-chip 8088 solutions were initially replaced by highly integrated 8-bit single-chip microcomputer devices such as the 8048 and 8051. These devices were tailored to work best as event controllers. For instance, the 8051 offers one-order-of-magnitude higher performance than the 8088, a more powerful instruction set, and special on-chip function such as ROM, RAM, timer/counters, universal asynchronous receiver/transmitter (UART), programmable parallel I/O ports, DAC, and ADC. Today these types of single-chip microcomputers are also called microcontroller. The microcontrollers are widely used in industrial control systems as shown in

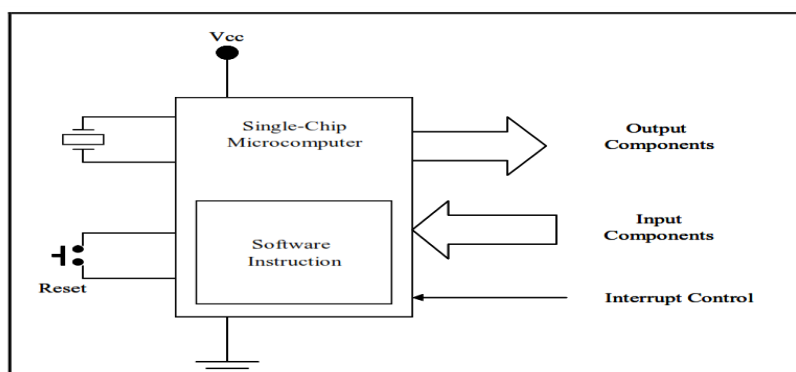


Fig. 3.4. Single chip microcontroller

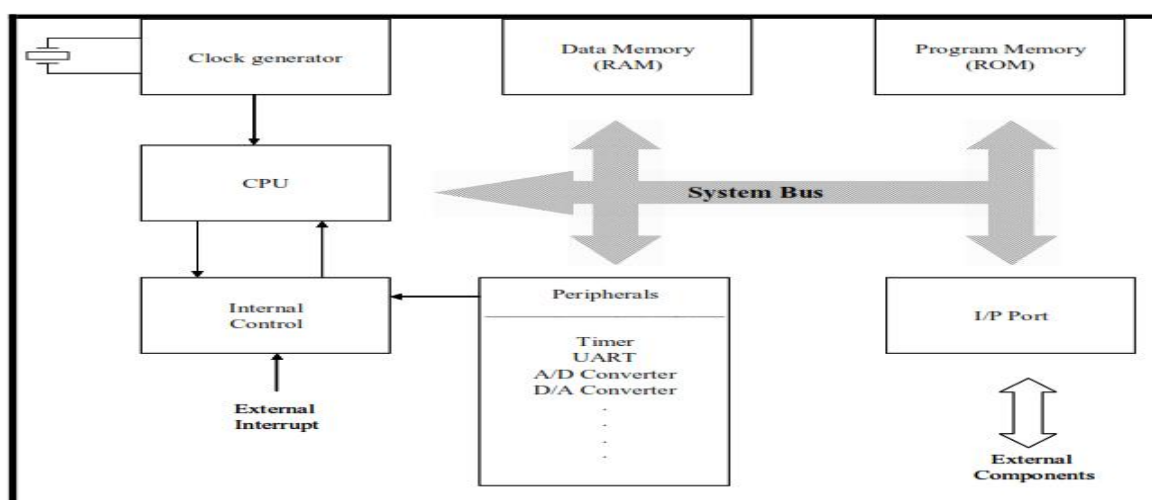


Fig.3.5. Shows the architectural structure of a single-chip microcomputer system.



### 1. Clock Generator

Single-chip microcomputer is a sequential logic circuit normally driven by a clock generator, a device that emits a periodic sequence of pulses. These pulses define machine cycles. During each machine cycle, some activity occurs, such as the execution of an instruction.

### 2. CPU

The CPU is the brain of the single-chip microcomputer. Its function is to execute programs stored in the program memory by fetching their instructions, examining them, and then executing one after another. The CPU is composed of several distinct parts. The control unit is responsible for fetching instructions from program memory and determining their type. The ALU performs arithmetic and logical operations.

### 3. Interrupt control

Interrupt request signals may come from the on-chip peripheral such as timer/counter or external device such as keyboard. The interrupt control circuit receives these requests and determines which request is acknowledged according to the priority level specified.

### 4. Data Memory

The data memory or RAM is used to store data. A part of on-chip data memory is used to store temporary results and certain control information. This memory consists of a number of registers, each of which has a certain function.

### 5. Program Memory

The program memory or ROM is used to store program instructions. IT is divided into the following categories: PROM, EPROM, EEPROM, and Flash.

### 6. I/O Port

The I/O port is an interface between CPU and external devices such as switches and LEDs. Compared with general-purpose microcomputers, single-chip microcomputers provide more I/O ports and more powerful instructions for I/O handling. The more the I/O ports, the more I/O devices can be connected.

### 7. On-chip Peripherals

On-chip peripheral circuits are a single-chip microcomputer offer various special control functions such as timer/counters. Serial ports, PWM, even ADCs and DACs. In general, the more the on-chip peripheral, the higher the system performance.

## 1.3 Symptoms of Software and Hardware Faults

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## Sorting Hardware/Software/ Configuration Problems

One of the first steps in troubleshooting a computer problem (or any other programmable system problem) is to determine whether the problem is due to a hardware failure or to faulty software. In most PCs, you can use a significant event that occurs during the startup process as a key to separate hardware problems from software problems: the single beep that most PCs produce between the end of the power-on self test (POST) and the beginning of the startup process.

Errors that occur, or are displayed, before this beep indicate that a hardware problem of some type exists. Up to this point in the operation of the system, only the BIOS and the basic system hardware have been active. The operating system side of the system does not come into play until after the beep occurs.

If the system produces an error message (such as “The system has detected unstable RAM at location x”) or a beep code before the single beep occurs, the system has found a problem with the hardware. In this case, a bad RAM memory device is indicated.

Typically, if the startup process reaches the point at which the system’s CMOS configuration information is displayed onscreen, you can safely assume that no hardware configuration conflicts exist in the system’s basic components. After this point in the boot up process, the system begins loading drivers for optional devices and additional memory.

If the error occurs after the CMOS screen displays and before the boot up tone, you must clean boot the system and single-step through the remainder of the boot up sequence.

You can still group errors that occur before the beep into two distinct categories:

- Configuration errors
- Hardware failures

A special category of problems tends to occur when a new hardware option is added to the system, or when the system is used for the very first time.

These problems are called *configuration problems*, or *setup problems*. These problems result from mismatches between the system’s programmed configuration held in CMOS memory and the actual equipment installed in the system.

It is usually necessary to access the system’s CMOS setup utility in the following three situations:

- When the system is first constructed.
- When it becomes necessary to replace the CMOS backup battery on the system board.



➤ When a new or different option is added to the system (such as memory devices, hard drives, floppy drives, or video display), it might be necessary to access the setup utility to accept the changes that have been implemented.

In most systems, the BIOS and operating system use plug-and-play techniques to detect new hardware that has been installed in the system. These components work together with the device to allocate system resources for the device. In some situations, the PnP logic is not able to resolve all the system’s resource needs and a configuration error occurs. In these cases, the user must manually resolve the configuration problem [12].

When you are installing new hardware or software options, be aware of the possibility of configuration errors occurring. If you encounter configuration (or setup) errors, refer to the installation instructions found in the new component’s installation/user documentation.

If you cannot confirm a configuration problem, you most likely have a defective component. The most widely used repair method involves substituting known-good components for suspected bad components. Other alternatives for isolating and correcting a hardware failure that appears before the boot up depend on how much of the system is operable.

Normally, symptoms can be divided into three sections: configuration problems, boot up problems, and operational problems.

The system’s configuration settings are normally checked first. It is important to observe the system’s symptoms to determine in which part of the system’s operation the fault occurs. The error messages described in Table 3.1 are errors that occur and are reported before the single beep tone is produced at the end of the POST routines.

Configuration error Message	Meaning
CMOS System Option not yet	Failure of CMOS battery or CMOS Check sum set
CMOS Display Mismatch	Failure of display type verification
CMOS Memory Size Mismatch	System Configuration and set up failure
Press F1 to continue	Invalid Configuration Information
CMOS time and date not set	Failure of CMOS Battery

Table3.1 System configuration problem

After the beep tone has been produced in the startup sequence, the system shifts over to the process of booting up and begins looking for and loading the operating system. Errors that occur between the beep



and the presentation of the operating system's user interface (command prompt or GUI) generally have three possible sources. These sources are summarized in the following list that includes the typical error messages associated with each source.

- Hardware failure (physical problem with the boot drive)
- General Failure Error Reading Drive x

Corrupted or missing boot files

- Bad or Missing Command Interpreter
- *Non system Disk or Disk Error*
- *Bad File Allocation Table*
- Corrupted or missing operating system files

Both configuration problems and boot up problems can be caused by a hardware or operational failure. If the configuration settings are correct, but these symptoms are present, a hardware problem is indicated as the cause of the problem. Conversely, Boot up problems are typically associated with the operating system.

Hardware Troubleshooting Tools

The level of troubleshooting most often performed on PC hardware is exchanging *Field Replaceable Units (FRUs)*. Due to the relative low cost of computer components, it is normally not practical to troubleshoot failed components to the IC level. The cost of using a technician to diagnose the problem further, and repair it, can quickly exceed the cost of the new replacement unit. However, a few hardware diagnostic tools can be very helpful in isolating defective hardware components. These tools include

- Software diagnostic disk
- Multi-meter
- Cable tester
- POST card

Software Diagnostic Packages

Several commercially available disk-based diagnostic routines can check the system by running predetermined tests on different areas of its hardware.



The diagnostic package evaluates the response from each test and attempts to produce a status report for all of the system's major components. Like the computer's self-tests, these packages produce visual and beep-coded error messages.

Self Check #4	Written Test
---------------	--------------

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time Start: \_\_\_\_\_

Time Finish: \_\_\_\_\_

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

II. Explain the following question

1. Write the possible cause and solution when the computer has No sound?(4 points)
2. What is Troubleshooting? (2 point)
3. What are the five basic units of microcomputer system? (5 points)
4. A special category of problems tends to occur when a new hardware option is added to the system, or when the system is used for the very first time is?(1 point)
5. Write at least three Common hardware problems and their solution?(5 points)

Note: Satisfactory rating –8.5 points

Unsatisfactory - below 8.5 points

You can ask your teacher for the copy of the correct answers.

Scored Points



<b>LG #23</b>	<b>LO#4 Apply maintenance procedure</b>
<b>Instruction Sheet</b>	

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Implementing OH&S procedures.
- Identifying diagnostic tools
- Identifying appropriate maintenance procedure
- Applying preventative maintenance schedule.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Implement OH&S procedures and practices in computer maintenance
- Identify diagnostic tools and appropriate maintenance procedure
- Apply preventive maintenance.

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, and Sheet 4”.
4. Accomplish the information “Sheet in page
5. Try to answer self-check, you can ask your trainer for correction. If you finished answering the Self-check, take correction or explanation from your trainer if it is not clear.
6. If you scored a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, discuss with your trainer for further instructions or go back to learning Submit your accomplished Self-check. This will form part of your training portfolio.
7. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you Instructor for assistance if you have hard time understanding them.
8. Accomplish the “Self-check 2” in page

Ask from your teacher for correction (key answers) if any.



9. Read the information written in the “Information sheet 3. Try to understand what are being discussed and ask you teacher for assistance if you have hard time understanding them.
10. Accomplish the “ self check ” in page
11. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (To get the key answer only after you finished answering the Self-check 3).
12. If you scored a satisfactory evaluation proceed to “Operation Sheet 1” in page, however, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1
13. Read the “ operation sheet ” and try to understand the procedures discussed.





## Information sheet 1:

## Scheduling Preventative maintenance

### 1.1. Scheduling preventive maintenance

Scheduled maintenance is work based on known information, such as number of operations, hours run, mileage, etc., and can therefore be carried out at a predetermined time interval.

Preventive maintenance is predetermined work performed to a schedule with the aim of preventing the wear and tear or sudden failure of equipment components.

Preventive maintenance helps to:

Protect assets and prolong the useful life of production equipment  $f$

- Improve system reliability  $f$
- Decrease cost of replacement  $f$
- Decreases system downtime  $f$
- Reduce injury

Preventive maintenance, therefore, is a very important ongoing accident prevention activity, which you should integrate into your operations/ product manufacturing process[1].

To be effective, your preventive maintenance function should incorporate the following elements:

Planned replacements of components designed around the following:  $f$

- Reliability of components (equipment failure is usually caused by its least reliable component)
  - ✓ Check manufacturer's information.
  - ✓ check accepted industry best practices  $f$
- Maintaining equipment service records  $f$
- Scheduling replacement of components at the end of their useful service life
- Acquiring and maintaining inventories of:
  - ✓ least reliable components
  - ✓ critical components
  - ✓ components scheduled for replacements  $f$
- Replacing service-prone equipment with more reliable performers.



## 4.2. Setting Up a Preventive Maintenance Schedule

Setting up a customized preventive maintenance schedule is aimed at achieving the above outcomes. Here are five tips to make this happen:

### 1. Getting a Handle on Your Assets

Since company assets are unique and vary by industry and sector, size of the organization and production activities, there is no “cookie cutter” method to developing an inventory list for the purpose of developing a preventive maintenance schedule. At the outset, determinations need to be made about which assets require routine checks and which do not. In general, company assets that will benefit most from a preventive maintenance schedule are those that have a critical operational function, failure modes that can be prevented with routine maintenance and a likelihood of failure that increases with time or use. Assets less amenable to preventive maintenance scheduling may be better handled using spreadsheet systems.

### 2. Use Architectural Drawings to Locate Assets

An architectural drawing is a rendering of an architectural design as plan and/or elevation views of a building or structure. Using these drawings make it possible to view supply levels visually rather than in a spreadsheet format alone.

Most important, exact locations of equipment can be highlighted on the drawings. Knowing the locations of critical equipment in need of preventive maintenance software can facilitate efficient preventive maintenance scheduling because technicians can be deployed to service several pieces within close proximity in a shorter time frame as opposed to the time required to service items spread throughout a facility [15].

This approach results in better time and resource utilization management



### 3. Gather Operating and Maintenance Manuals and Serial Codes

An important aspect of establishing equipment maintenance schedules is becoming familiar with equipment O&M manuals which among other things, set out recommended maintenance schedules and procedures as well as troubleshooting information.

Serial codes are important to ensure that when replacement parts are needed, the correct ones are ordered.

An efficient preventive maintenance will benefit from technicians who are knowledgeable about the assets they are servicing as well as having the appropriate parts on hand, when needed.

### 4. Review Equipment Repair Histories

Apart from setting preventive maintenance schedule based on O&M manual recommendations alone, gaining additional information about asset use and repair histories can be helpful.

Since no two operations are identical, O&M manual recommendations are just that – recommendations.

They do not replace a thorough review of repair and inspection histories. This added information is beneficial in fine tuning preventive maintenance schedules to reflect the actual usage and performance of a particular piece of equipment [16].

Equally important, a review of the repair histories will provide valuable information about prior downtime and serve as a baseline upon which improvements can be targeted.

### 5. Initiate, Review and Adjust

The only way to know how well a preventive maintenance is performing is to put it into motion and then review the repair and supply reports after six months. At that time, it may be determined that the schedules in place are operating efficiently as is.



Alternatively, it may be determined that some assets require more frequent maintenance while others require less. It may also be determined that an asset is better replaced because repairs have become too frequent and the associated downtimes interfere with company operations.

<b>Self Check #1</b>	<b>Written Test</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time Start: \_\_\_\_\_

Time Finish: \_\_\_\_\_

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

III. Explain the following question

6. Explain What is preventive maintainance (4 points)
7. Explain how to plan replacement of components? (2 point)
8. What is the use of preventive maitainace? (5 points)
9. What is reliability of components? (1 point)
10. Explain Protect assets and prolong the useful life of production equipment?(5 points)

*Note:* Satisfactory rating –8.5 points

Unsatisfactory - below 8.5 points

You can ask your teacher for the copy of the correct answers



<b>Information sheet 2</b>	<b>Identifying specific maintenance procedure</b>
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## 2.1. Maintenance Procedure

Maintenance procedures are written instructions that, when followed by the maintenance personnel, will ensure that equipment operates as designed within safe operating limits.

## 2.2. Procedures, records and histories

A policy governing the use of procedures and the handling of deviations from the procedures should be implemented and communicated to staff.

Maintenance procedures and other work-related documents should identify preconditions and precautions, provide clear instructions for work to be done, and be used to ensure that maintenance is performed in accordance with the maintenance strategy, policies and programmes. The procedures should normally be prepared in cooperation with the designers, the suppliers of plant and equipment, and the personnel conducting activities for quality assurance, radiation protection and technical support. They should be technically accurate, properly verified, validated, authorized and periodically reviewed. Priority should be given to amending and updating procedures in a timely manner. A mechanism should be implemented which enables users to feed back suggestions for the improvement of procedures.

Maintenance instructions issued to craftsmen should be compiled in accordance with quality assurance requirements and should point out the risk impact of the work on nuclear and personnel safety and identify the countermeasures to be taken and specify the post-maintenance/modification testing required. The required level of skill and methods of procedure use should be stated. Routine activities involving skills that qualified personnel usually possess may not require detailed step-by-step instructions; they should nevertheless be subject to control by means of general administrative procedures.

Human factors and 'As Low As Reasonably Achievable' (ALARA) principles should be considered in the preparation of maintenance instructions [13].

Maintenance history should be used to support maintenance activities, upgrade maintenance programmers', optimize equipment performance and improve equipment reliability. Appropriate



arrangements should be made for orderly collection and analysis of records and production of reports on maintenance activities. Maintenance history records should be easily retrievable for reference or analysis. The use of computerized maintenance history handling would facilitate this process[3].

**2.3. Maintenance procedures that should be considered when preparing the planned maintenance program include:**

1. Carrying out repairs needed when plant or equipment breaks down;
2. Predicting, from a history of breakdowns, the life expectancy of parts, bearings, etc., the tasks to be carried out and the frequency to be established;
3. Checking the condition throughout the plant of equipment, its running hours, readings of different responses (e.g. vibration, temperatures, current, etc.);
4. Monitoring the operating cycle and, where appropriate, seasonal shutdowns of plant, equipment (e.g. production process, 24-hour duty, etc.).

<b>Self Check #2</b>	<b>Written Test</b>
----------------------	---------------------

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

- IV. Explain the following question
1. Explain maintenance procedures(10 points)
  2. Explain Maintenance procedures that should be considered when preparing the planned maintenance program include 10 (points)?

*Note:* Satisfactory rating –11 points      Unsatisfactory - below 11 points

You can ask your teacher for the copy of the correct answers



<b>Information sheet 3</b>	<b>Documenting and submitting of procedures</b>
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### 3.1. Documenting Of Procedures

#### 3.1.1. Process Documentation?

Process documentation provides a detailed description of how to carry out a business process.

It includes all types of documents that support a process, like

- policies
- checklists
- tutorials
- forms
- screenshots
- links to other applications
- process maps

It is used as a guide to help employees at all levels, including decision makers and stakeholders, quickly understand company processes.

#### 3.1.2. The Importance of Process Documentation

Documenting a process will help you achieve 5 key things[4]:

- 1) **Helps improve processes.** Identify bottlenecks and inefficiencies by documenting the exact processes. You'll quickly see what processes that you need to improve or get rid of.
- 2) **Helps train employees.** You can use process documents to help new employees understand their job roles and familiarize themselves with the processes they'll be involved in. Even experienced employees can still refer to these documents whenever they want to make sure that they are executing the process right.



- 3) **Helps preserve company knowledge.** Keep a record of processes known only to a few people specialized in doing them. That way even when they leave, the newcomers can resume the work easily.
- 4) **Helps mitigate risks and maintain operational consistency.**
- 5) Detailed process documentation is also **a vital part of patents and trade secrets**

### 3.1.3. Who is Involved in Process Documentation

There are 3 key ownership roles in process documentation. In some cases, the same person may play all three roles.

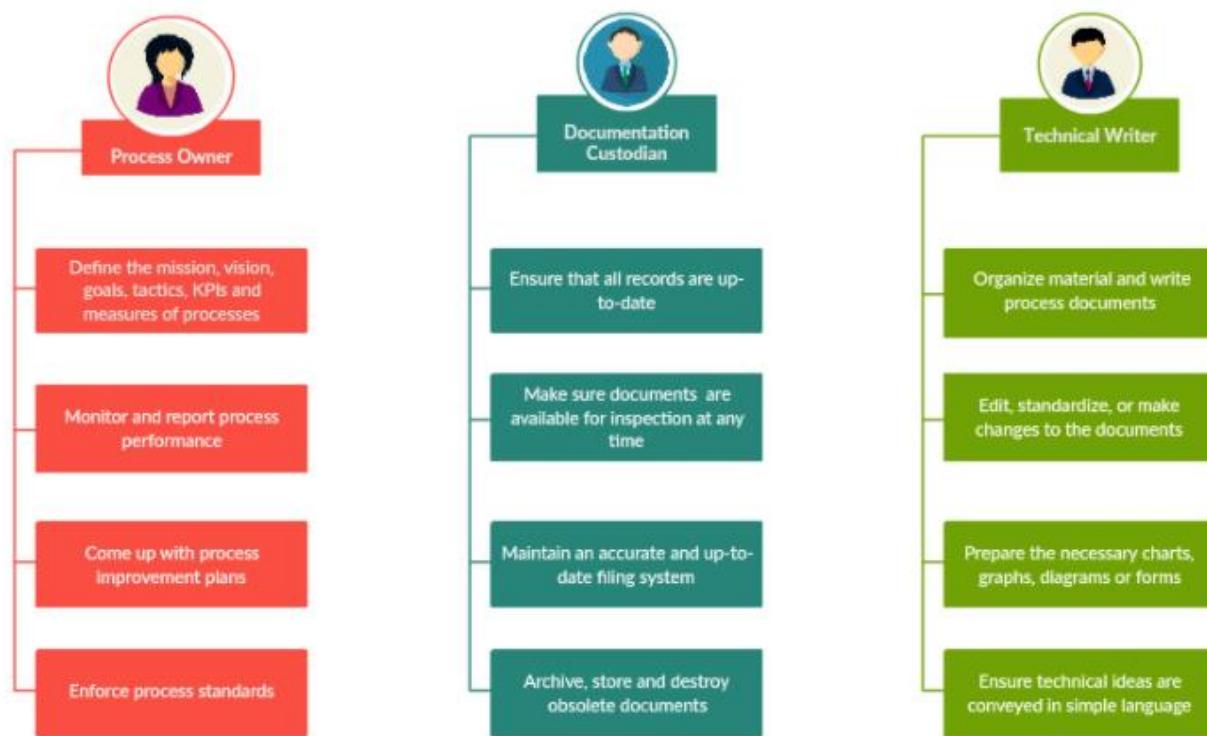


Figure 3.1. Process Documentations

### 3.2. Submitting of Documents





You have received a link or a code for your submission. Either follow the link or enter the code at your organization's submission portal.

1. Enter your first and your last name as well as the title of your document.
2. Add a personal message to the professor and comments you want to pass on to him.
3. Select the document you want to submit from your folder or use drag and drop to upload your file. If your paper is stored online, click web import, and either enter the URL address or choose it from your cloud service.
4. To receive an email confirmation of your submission, enter your email address under notification email. If you do not wish to receive any emails, just uncheck the checkbox above it. If the submission creator (e.g. your teacher) has allowed it, you can also check a checkbox to receive your report per email.
5. Click Submit file. The maximum amount of data that can be imported at any one time is set to 100 MB

<b>Self Check #3</b>	<b>Written Test</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Finish: \_\_\_\_\_

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

- I. Explain the following question
  1. Explain How to submit a document (10 points)
  2. Explain the importance of documenting process10 (points)?

*Note:* Satisfactory rating –11 points      Unsatisfactory - below 11 points

You can ask your teacher for the copy of the correct answers



<b>Information sheet 4</b>	<b>Observing OHS throughout the process</b>
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#### 4.1. Introductions

Safe and healthy workplaces are often taken for granted in the Ethiopia. But today’s safety-conscious factory floors and well-lit offices are a relatively recent invention of modern society—a direct result of efforts made by those working in the field of occupational health and safety.

Dedicated to studying and preventing workplace injuries and illnesses, the field of occupational health and safety is responsible for the overwhelmingly-positive outcomes achieved for American workers over the past 200 years. Dangerous machinery and poorly ventilated factories, once commonplace, have made way for safer, cleaner environments for employees. The combination of legislation, executive branch regulation, and self-regulation by responsible businesses has transformed the American workplace. As a result, accident and fatality rates across most industries have dropped steadily for decades a trend that continues even today [14].

Occupational health and safety is the field of public health that studies trends in illnesses and injuries in the worker population and proposes and implements strategies and regulations to prevent them. Its scope is broad, encompassing a wide variety of disciplines from toxicology and epidemiology to ergonomics and violence prevention.

#### 4.2. Observing OHS throughout the process

This unit describes the performance outcomes, skills and knowledge required to participate in workplace occupational health and safety (OHS) processes to protect workers own health and safety, and that of others. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement [5].



<b>Unit title</b>	<b>Participate in OHS processes</b>
<b>Descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to participate in workplace occupational health and safety (OHS) processes to protect workers own health and safety, and that of others.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
<b>National code</b>	BSBOHS201A
<b>Employability skills</b>	This unit contains employability skills.
<b>Pre/co-requisite units</b>	Nil
<b>Application</b>	This unit applies to individuals who require a fundamental knowledge of OHS to carry out their own work which may be in a defined context under direct supervision or with some individual responsibility. This unit has broad applicability across industries and workplace contexts.

<b>Element 1 Work safely</b>
1.1 Follow established <b>safety procedures</b> when conducting work
1.2 Carry out pre-start systems and equipment checks in accordance with workplace procedures
<b>Element 2 Implement workplace safety requirements</b>
2.1 Identify <b>designated persons</b> for reporting queries and concerns about safety in the workplace
2.2 Identify existing and potential <b>hazards</b> in the workplace, report them to designated persons and record them in accordance with workplace procedures
2.3 Identify and implement workplace procedures and work instructions for controlling risks
2.4 Report <b>emergency incidents</b> and injuries to designated persons



<b>Element 3 Participate in OHS consultative processes</b>
3.1 Contribute to workplace meetings, inspections or other consultative activities
3.2 Raise OHS issues with designated persons in accordance with organisational procedures
3.3 Take actions to eliminate workplace hazards or to reduce <i>risks</i>
<b>Element 4 Follow safety procedures</b>
4.1 Identify and report emergency incidents
4.2 Follow organisational procedures for responding to emergency incidents

Required skills and knowledge Required skills

- literacy skills to interpret safety signs, symbols and notices
- problem-solving skills to analyze options in an emergency situation.

Required knowledge

- responsibilities of employers and employees under relevant health and safety legislation
- emergency procedures including procedures for fires and accidents
- commonly used hazard signs and safety symbols

<b>Self check 4</b>	<b>Written test</b>
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

Time Start: \_\_\_\_\_

Time Finish: \_\_\_\_\_

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

I. Explain the following question



1. Explain Observing OHS throughout the process (10 points)
2. Explain Required skill knowledge of observing OHS throughout the process 10 (points)?

*Note:* Satisfactory rating –11 points                      Unsatisfactory - below 11 points

You can ask your teacher for the copy of the correct answers

<b>Operation Sheet #2</b>	<b>Apply Maintenance Procedure</b>
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**Operation Title:** - CPU problems and trouble shootings:

**Purpose:** - The trainee’s will be able to: troubleshoot & give solutions to CPU, adapter cards problems & give the solution, troubleshoot power problems& give the solution, use power protection devices

Conditions or situations for operation: - Have a clean workspace with all necessary tools and equipment

Equipment, Tools &Materials: - Maintenance room, computer, cpu, Maintenance tool kit, table, chair etc.

**Procedure1.** General power problems & troubleshooting

The general power problems can be categorized in three types:

1) Power Quality problem

Possible causes:

- EMI (Electro-Magnetic Interference] .
- Variable rate [frequency] from the power line.,

2) Too much power

Possible causes:

- Power spike [for few milliseconds].
- Power surge [for several seconds].

3) No-enough power

Possible causes:

- Power sag [for few mill second]
- Brownout [if sag lasts for longer than a second]



- Blackout [a complete of power failure]

Protection against power problems

You can use the following devices for proper: Line conditioner, Stabilizer, Surge suppressor, UPS

Note: UPS is Uninterrupted Power Supply. The UPS is also known as battery backup

Problem

- Monitor's power indicator lights but no power lights on the system unit.

Solution

- Check the system unit's power connection.
- Check your power supply DC volt outlet.
- Use a replacement method for power supply.
- Check also the motherboard.

Power supply symptoms

- Fan noise sounds rough or louder than usual.
- Fan noise is absent altogether.
- The power supply chassis is unusually hot to touch.

General troubleshooting methods

- Check the power cable.
- Check the power supply [you can use a Multi- meter to test electronic components].  
Check the power outlet voltage.
- Replace the power supply unit.

Problem

- A PC accidentally reboots or shutdown

Solution

- Check your power line.
- Make sure that your power supply is rated [watt" to handle all the peripherals that it powers [300watt or above is better]
- Check the power supply fan movement. • Use a replacement method.

Procedure1. CPU problems and trouble shootings:

Problem

Both the CPU and power supply fan work Properly but the system shows a blank screen.

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## Solution

The CPU might be damaged. Use the replacement method.

CPU problem Possible causes:

- Overheating.
- Static discharge.
- Bent or Broken pins.

General symptom of CPU

- The system fails to Boot (start).
- Black Screen.
- The system boots, but the operating system (windows) fails to load.
- The system locks-up or dies after several minutes of operations.
- The system says "hardware monitor error ....."

**Procedure 2.** Sound Card problems and trouble shootings:

Sound card

Usually built-in the motherboard and is used to give sound through the speakers.

**Problem**

➤ **No sound from the Computer**

Possible cause:

- Software related problem.
- Speaker connection failure.

Solution

- Check your speaker and its connection.
- Check the volume control in the windows system
- Check the driver software for the sound card.

**Problem**

➤ **No sound from the CD drive**

Solution

- Check the disc into another system.
- The audio cable connecting the CD drive to Sound card is detached. Therefore, unplug off] the PC and reattach the audio cable to sound card.



- Run any sound card diagnostic software.
- Use the replacement method.

**Procedure 3.** Modem Card problems and trouble shootings:

In order to connect the computer to the Internet connection, you must have a modem card between the motherboard and Telephone line.

**Problem**

- Modem cannot dial and "no Dial tone" message appears on the monitor

**Solution**

- Check the phone card connection.
- Make sure the jack on the modem labeled "line" is connected to phone line wall jack.

**Precautions:-**

- Take ESD precautions.
- Power all devices and disconnect them from the main power supply.

**Quality Criteria:-**

- The trainee's use safety for components.
- The trainee's make troubleshoot & solve problems.

<b>LAP TEST #2</b>	<b>Practical Demonstration</b>
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** You are required to perform the following individually with the presence of your teacher.

1. From the given Computer/PC:

- Demonstrate the major probable faults
- Identify faults
- Rectify or troubleshoot the problems on it

- *Your teacher will evaluate your output either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic.*





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This TTLM developed on September 2020 at Bin International Hotel, Bishoftu.

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