Sheet # 1
Module 01: Systems Foundation

Part 1: Introduction (For Reading)

What is Operational Research?

- Operational Research (OR) is the use of advanced analytical techniques to improve decision making.
- It is sometimes known as operations research, management science or industrial engineering.
- People with skills in OR hold jobs in decision support, business analytics, marketing analysis and logistics planning – as well as jobs with OR in the title.

Why is OR needed?

Because it makes sense **to make the best use of available resources**. Today's global markets and instant communications mean that customers expect high-quality products and services when they need them, where they need them. Organizations, whether public or private, need to provide these products and services as **effectively and efficiently as possible**. **This requires careful planning and analysis** – the hallmarks of good OR. This is usually based on process modeling, analysis of options or business analytics.

Examples of OR in action

- **Yield management:**

  Setting the prices of airline seats and hotel rooms to reflect changing demand and the risk of no shows.

- **Credit scoring:** شركات التأمين

  Deciding which customers offer the best prospects for credit companies.

- **Marketing:**

  Evaluating the value of sale promotions, developing customer profiles and computing the life-time value of customer.

- **Defence and peace keeping:**

  Finding ways to deploy troops rapidly.

Some OR methods and techniques:-

- **Computer simulation:**

  Allowing you to try out approaches and test ideas for improvement.

- **Optimization:**

  narrowing your choices to the very best when there are so many feasible options that comparing them one by one is difficult.

- **Probability and statistics:**

  helping you **measure risk, exa**mine data to find valuable connections and insights in business analytics, test conclusions, and make reliable forecasts.

- **Problem structuring**:

  helpful when complex decisions are needed in situations with many stakeholders and competing interests.

Part 2: Questions

1. Explain the meaning of systems.

- A system is a set of interacting units or elements that form an integrated whole intended to perform some function.
- System's purpose is the reason for its existence.

2. Declare the different characteristics of a system.

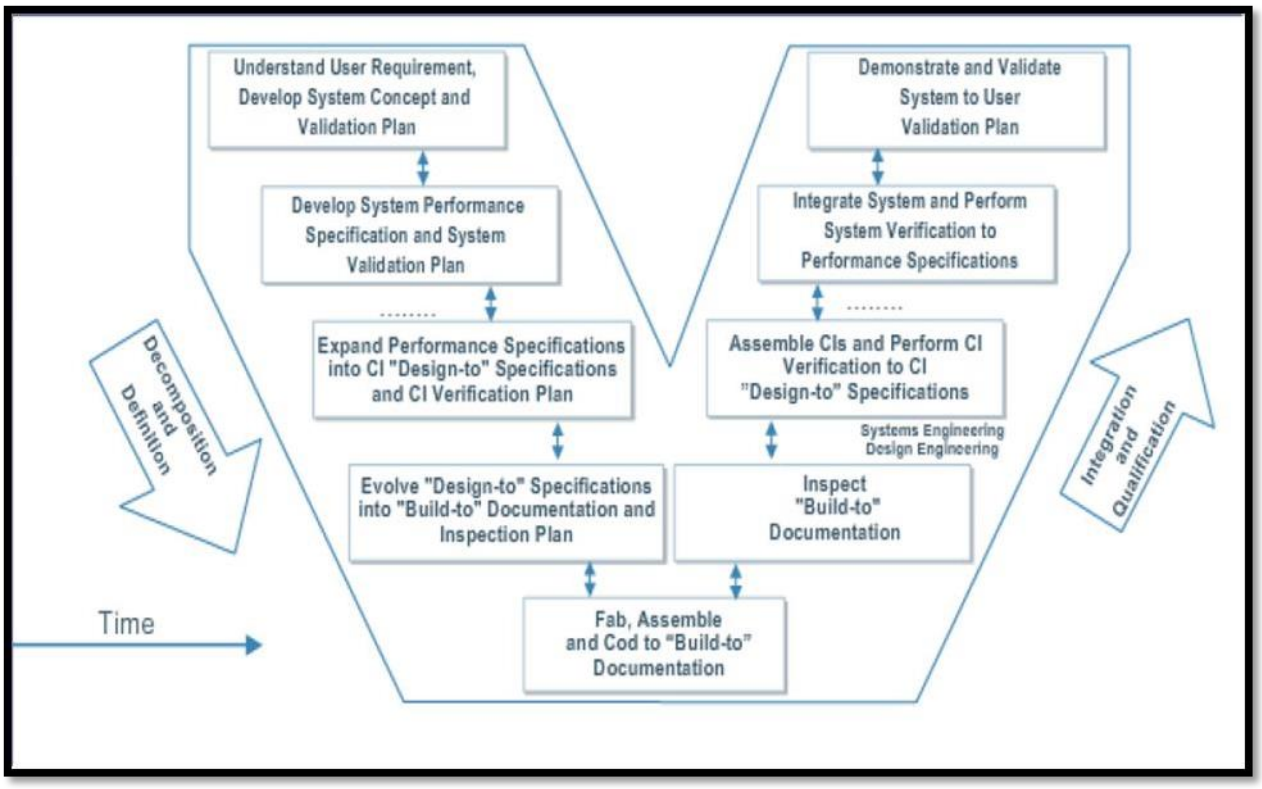
Purpose
Performance measurement
User
Components
Environment
Decision Maker
Designer
Value maximization
Stability

3. Select a complex engineering system (High dam for example) and try to discuss different system characteristics.

A computer is a complex engineering system where:

- Its **purpose** is to pursue operations of mathematical nature
- Its **performance** can be determined by the number of operations it can do in unit time, their complexity level, and the storage mass
- Its **user** is either a regular person or a scientist
- Its **components** are: CPU, I/O peripheral, RAM, & storage devices.
- It is present in a lab, indoors, outdoors. Every one of them is an **environment**
- **Decision making** is done by the OS.
- **Designed by** the producing company engineering department.
- We may change its components to maximize its use; e.g. enabling/ disabling some running services on the OS.
- **In order to ensure stability**, some components may be activated (e.g. fan) or deactivated/slowed down (e.g. processor/CD/HDD)

4. Describe and sketch the V Model of the engineering process for a system.



5. Discuss the engineering methodologies provided in the module.

- V-Model
- TTDSE (Traditional Top Down System Engineering)
- Water fall model
- Spiral modeling
- OO modeling (UML)

6. Difference between open and closed systems.

- An open system is always dependent upon an environment with which it can exchange matter, energy and information.

OR

- Open systems refer to that interact with other systems or the outside environment.
- The closed system is open for input of energy only.

OR

- The closed system systems having relatively little interaction with other systems or the outside environment
- The differences between open and closed systems are relative. For example, an organism is a typical example of an open system but, taken together with its environment, it may be considered as a closed system.