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## Control Systems Interview Questions

### Q1. What is a control system?

It is the system of devices that maintains, directs or regulates the behavior of other devices or systems to achieve the desired result. It can be a thermostat used to control domestic boiler to large **Industrial Control System** which is used for controlling processes. In short, it is a system that is used to control other systems.

### Q2. List different types of control system?

There are several types of control systems, which can be widely described in two systems

1. linear control systems
2. non-linear control systems

### Q3. What is time-invariant System?

**Time invariant:** A system is considered as time invariance if the behavior of the system is independent of the time at which input is applied. It is the property of the system that makes the system independent of time. For a system to be time-invariant, it must follow the same time shift (delay or advance) between the input signal and the output signal.

### Q4. What is disturbance? List its types?

A disturbance signal is generally observed in the control system. It is the unnecessary inputs that affect the control system's output. Due to this, an error occurs in the system. Control-system engineers set up the system with proper design to maximally eliminate the effects of disturbances on the output and system error.

**Types of disturbances in the control system are:**

- Change in setpoint - The setpoint is the desired value of the measured variable.
- Change in supply - This is a change in any of the energy inputs to the process.
- Change in Demand- This defines a change in the output flow of energy.
- Environmental Changes- Change in temperature or atmospheric pressure.

## Types of disturbance that enter control loops from the outside:

- setpoint changes
- load variations
- noise

## Q5. What is SisO and MIMO?

**SISO** stands for Single INPUT Single Output.

- It is the simplest antenna technology.
- It is the wireless technology used for a communication system in which one antenna is used at the destination(receiver) and another one is at the source(transmitter).

**MIMO** stands for Multiple Input Multiple Output. In MIMO, a packet is transmitted into more than one antenna in a channel and when that packet comes out, it is received on multiple antennas.

## Q6. What is Open loop system?

An **Open-loop system** is also characterized as a non-feedback system in which the output does not affect the control action of the input signal. In this system, input commands or set are followed regardless of the result.

Simply put, the output is neither measured nor fed back.

## Q7. What are linear and non-linear systems?

Before discussing linear and non-linear system, you need to know about term Homogeneity. It is a term defined for those systems, in which, if the input is multiplied with a constant then the output will also be multiplied with the same constant.

### Linear Control Systems

In a linear control system, we get a linear voltage and current characteristics. In this, all the unwanted effects are ignored (which is possible only in theories) and it is assumed an ideal behavior of each element in the network. The linear control system follows the principle of Homogeneity and additivity. In this, the output is proportional to the input.

### Non-linear Control Systems

A nonlinear control system is defined as a system that does not follow the principle of homogeneity. In this system, the output is not proportional to the input. All the control systems in real life are nonlinear control systems.

### **Q8. What is closed loop System?**

A Closed-loop Control System is also referred to as a feedback control system. It uses the open-loop system as its forward path but the difference is that it has one or more feedback loops or paths between its output and its input. Put another way, some portion of the output is recovered "back" to the input to form part of the excitation of the system.

The major advantage of the **Closed-loop systems** is to automatically obtain and manage the desired output condition by comparing it with the actual condition.

### **Q9. What is Cut-off Rate?**

It is the important feature of the control system which distinguishes between a signal and a noise.

### **Q10. What is Gain Margin?**

### **Q11. What is a Block diagram?**

It is a pictorial representation that indicates the cause and effect of the relationship between the input and output of a physical system. A block diagram is used to identify the functional relationships among the various components of a control system.

### **Q12. What are metadyne and stroboscope?**

A metadyne is a direct current electric machine used as an amplifier or rotary transformer. It contains an additional set of brushes on the d-axis (direct axis) which are used to give the output while brushes of q-axis (quadrature axis) are short-circuited. This type of arrangement permits armature MMF to achieve higher power gains.

A **Metadyne** is also used to convert constant voltage input into the constant current but variable voltage output. In technical terms, it defines as "Metadyne is a cross-field DC machine that is designed to use armature reaction".

A **Stroboscope** is also known as a strobe tachometer or strobe light which is used to estimate the revolution velocity and frequency of rotating, vibrating or moving parts, components, and equipment. It is easy to adjust

the flash frequency to get an accurate analysis of the parameter. Stroboscope is used for the plant to find and replace springs, worn belts, valves and dampers as a component of a manufacturer's condition monitoring or preventative maintenance plan. Moreover, it is used to adjust machinery to streamline or enhance performance.

### Q13. What is Resonant Frequency?

The resonant frequency is used to calculate the natural frequency of vibration which is done by the physical parameters of the vibrating object. This idea is applied throughout the physics in electricity and magnetism, mechanics and also in the other modern branches of physics.

### Q14. What is Routh Hurwitz Stability Criterion?

As the name suggests, this criterion is given by two mathematician **Adolf Hurwitz** and **Edward John Routh** independently. It is a necessary test to validate the stability of a linear time-variant control system. The stability of the system is possible only

1. if either the roots of the first column have the same sign
2. if any sign is changed then the number of sign changes in the first column should be equal to the number of roots with positive real parts.

Thus, it shows the path to determine if equations of the linear system have stable solutions without directly solving the system.

### Q15. What is servo meter?

### Q16. What is the mathematical order of control systems?

### Q17. What Is Resonant Peak?

**Resonant Peak** is the maximum value of the magnitude of  $T(j\omega)$  which is denoted by  $M_r$ .

The value of  $M_r$  is:

$$M_r = \frac{1}{2\delta\sqrt{1-\delta^2}}$$

### Q18. What is signal flow graph?

Signal flow graph is the pictorial representation of the algebraic equation which includes nodes and branches. It

represents the set of equations.

### Q19. What is Masons Gain formula?

Mason's gain formula or MGF is a formula which is given by **Samuel Jefferson Mason** used in finding the transfer function of a linear signal-flow graph (SFG). It represents the relation between the input variable and the output variable in SFG.

### Q20. What is Cable Tray and its Type?

**Cable Trays** is an alternative way to support and protect the cables by providing a rigid structure to completely enclose wires. It upholds all types of wires such as High Voltage Power Lines, Power Distribution Cables, Control cables, Telecommunication Cables, and Fiber Optical Cables. Most cable trays systems are open which allows easy replacement and repair as per requirement.

**Types of Cable Tray: -**

- Ladder Type Cable Tray
- Solid Bottom Cable Tray
- Trough Cable Tray
- Channel Cable Tray
- Wire Mesh Cable Tray
- Single Rail Cable Tray

### Q21. What is Automatic Controller?

It is also known as an automatic regulator or controller. It is used to evaluate the value of a variable quantity or condition and then automatically acts on the controlled equipment to correct any deviation from a desired preset value. An automatic controller is a device or collection of devices through which automatic control is performed.

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