NPTEL: Automation & Controls
Module: 1 Introduction

Q.1. What are automated systems?

Ans: An automated system is a system that is used to reduce the need for human work in the production of goods and services. They help to increase productivity and the quality of the goods produced. In ideal, no human workers are needed except to perform auxiliary functions such as tool changing, loading and unloading parts, and repair and maintenance activities. Modern automated systems are integrated systems, operating under computer control.

Q.2. What are the major components of hydraulic systems?

Ans: Hydraulic systems contain the following key components:

Fluid - can be almost any liquid. The most common hydraulic fluids contain specially compounded petroleum oils that lubricate and protect the system from corrosion.

Reservoir – acts as a storehouse for the fluid and a heat dissipater.

Hydraulic pump – converts the mechanical energy into hydraulic energy by forcing hydraulic fluid, under pressure, from the reservoir into the system.

Fluid lines – transport the fluid to and from the pump through the hydraulic system. These lines can be rigid metal tubes, or flexible hose assemblies. Fluid lines can transport fluid under pressure or vacuum (suction).

Hydraulic valves – control pressure, direction and flow rate of the hydraulic fluid.

Actuators – converts hydraulic energy into mechanical energy to do work. Actuators usually take the form of hydraulic cylinders. Hydraulic cylinders are used on agricultural, construction, and industrial equipment.

Q.3. What are feedback control systems?

Ans: A type of control system that automatically changes the output based on the difference between the feedbacks signals to the input signal. The output is continuously measured and fed back to the controller which compares it with the desired output and generates controlling action to keep the errors to a minimum.

Q.4. What are the types of automated manufacturing systems?

Ans: Automated manufacturing systems can be classified into three basic types:

a. Fixed automation.
b. Programmable automation, and
c. Flexible automation.

Fixed Automation: Fixed automation is a system in which the sequence of processing (or assembly) operations is fixed by the equipment configuration. Each of the operations in the sequence is usually simple, involving perhaps a plain linear or rotational motion or an uncomplicated combination of the two; for example, the feeding of a rotating spindle. It is the integration and coordination of many such operations into one piece of equipment that makes the system complex. Typical features of fixed automation are:

- High initial investment for custom-engineered equipment
- High production rates
- Relatively inflexible in accommodating product variety

Programmable Automation: In programmable automation the production equipment is designed with the capability to change the sequence of operations to accommodate different product configuration. The operation sequence is controlled by a program, which is a set of instructions coded so that they can be read and interpreted by the system. New programs can be prepared and entered into the equipment to produce new products. Some of the features that characterize programmable automation include:

- High investment in general purpose equipment
- Lower production rates than fixed automation
- Flexibility to deal with variations and changes in product configuration
- Most suitable for batch production.

Flexible Automation: Flexible automation is an extension of programmable automation. A flexible automated system is capable of producing a variety of parts (or products) with virtually no time lost for changeovers from one part style to the next. There is no lost production time while reprogramming the system and altering the physical setup (tooting, fixtures, machine settings). Consequently, the system can produce various combinations and schedules of parts or products instead of requiring that they be made in batches. What makes flexible automation possible is that the differences between parts processed by the system arc not significant. It is a case of soft variety. So that the amount of changeover required between styles is minimal. The features of flexible automation can be summarized as follows:

- High investment for a custom-engineered system
- Continuous production of variable mixtures of products
- Medium production rate
- Flexibility to deal with product design variations