

**DEPARTMENT OF MECHATRONICS ENGINEERING**  
**19MCE301 DESIGN OF MECHATRONICS SYSTEMS**

**Two marks question with answers**

1. What is Mechatronics?

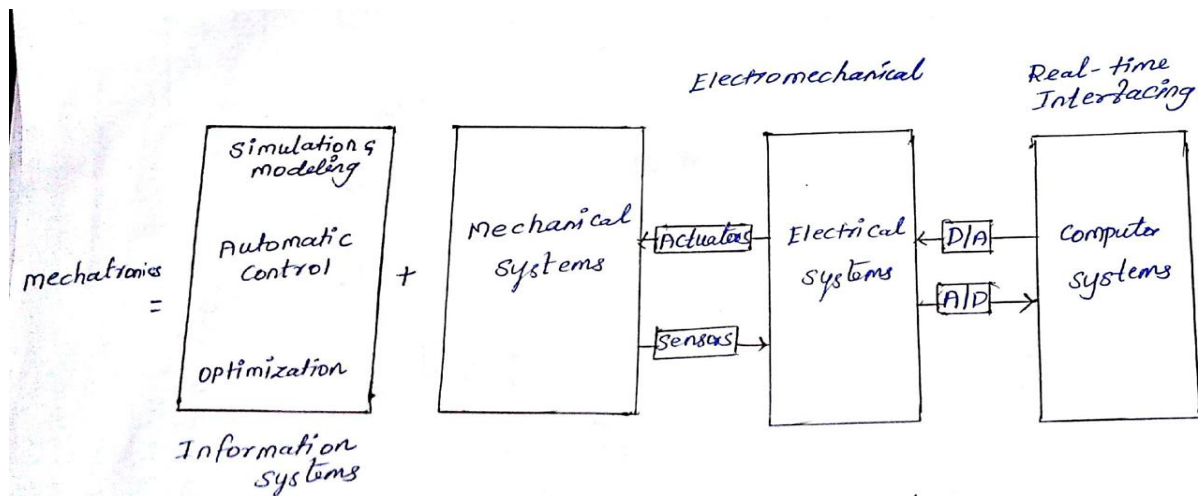
Mechatronics is a multidisciplinary field that refers to the skill sets needed in the contemporary, advanced automated manufacturing industry. At the intersection of mechanics, electronics, and computing, mechatronics specialists create simpler, smarter systems.

Mechatronics is an essential foundation for the expected growth in automation and manufacturing. Mechatronics deals with robotics, control systems, and electro-mechanical systems.

2. Define Physical System Modeling.

Physical modeling is a way of modeling and simulating systems that consist of real physical components.

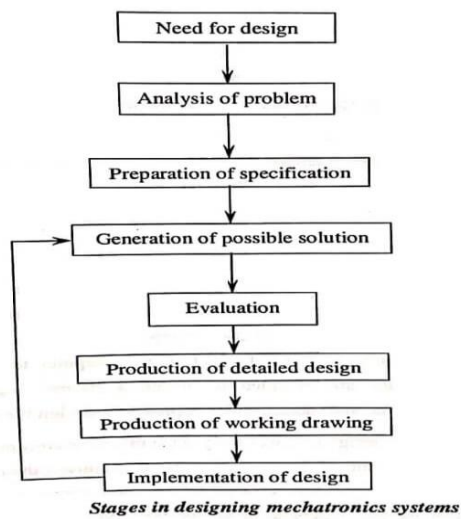
3. Draw the block diagram of Key elements of Mechatronics.



4. Recall the important life cycle factors in Mechatronics System

- Delivery
- Reliability
- Maintainability
- Serviceability

5. Write the Design steps involved in Mechatronics system design.



6. Define Model based Fault detection

Model based fault detection. Different approaches for fault detection using mathematical models have been developed. The task consists of the detection of faults in the processes, actuators and sensors by using the dependencies between different measurable signals.

7. Write the benefits of simulation.

- Simulation allows you to explore ‘what if’ questions and scenarios without having to experiment on the system itself.
- It helps you to identify bottlenecks in material, information and product flows.
- It helps you to gain insight into which variables are most important to system performance.

8. Write the disadvantages of Simulation.

- The quality of the analysis depends on the quality of the model and the skills of the modeller, who requires specialised training.
- It’s a time-consuming and expensive process, so should not be used if an analytical method can provide quicker results.

9. What is Replicative Validity?

Validity is affirmed if, for all the experiments possible within the experimental frame, the trajectories and system agree within acceptable tolerance, usually in space or time, included in a model, the greater the included detail, the higher the level of resolution.

#### 10. What is Predictive validity?

Validity of a model with respect to a system within an experimental frame. Is affirmed if, given the system,

- 1.) It is possible to initialize the model to a state such that
- 2.) For the same input trajectory the model output trajectory predicts the system output trajectory within acceptable tolerance

Predictive validity is a stronger criterion than replicative validity

#### 11. Write the merits of top down design sequence.

- Breaking problems into parts help us to identify what needs to be done.
- At each step of refinement, new parts will become less complex and therefore easier to solve. Some parts may turn out to be reusable.

#### 12. What is DAQ?

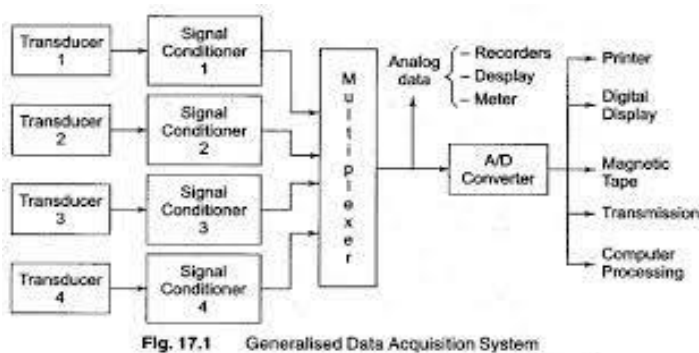
Data acquisition is the process of sampling signals that measure real-world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems, abbreviated by the acronyms *DAS*, *DAQ*, or *DAU*, typically convert analog waveforms into digital values for processing. The components of data acquisition systems include:

- Sensors, to convert physical parameters to electrical signals.
- Signal conditioning circuitry, to convert sensor signals into a form that can be converted to digital values.
- Analog-to-digital converters, to convert conditioned sensor signals to digital values.

13. Write the difference between the Analog signal and Digital Signal

Analog Signals	Digital Signals
Analog signal is continuous and time varying.	Digital signal have two or more states and in binary form.
Troubleshooting of analog signals are difficult.	Troubleshooting of digital signals are easy.
An analog signal is usually in the form of sine wave.	An digital signal is usually in the form of square wave.
Easily affected by the noise.	These are stable and less prone to noise.
Analog signals use continuous values to represent the data.	Digital signals use discrete values to represent the data.
Accuracy of the analog signals may be affected by noise.	Accuracy of the digital signals are immune from the noise.
Analog signals may be affected during data transmission.	Digital signals are not affected during data transmission.
Analog signal use more power.	Digital signal use less power.

14. Draw the schematic diagram of a simple DAQ system.



15. What is null modem?

A null modem is a specially designed cable that allows a “head-to-head” connection between two nearby serial devices (computers) through their communication ports (RS-232). Having a length limitation of up to 30 feet, it is most commonly used to connect PCs within the same room for gaming and other purposes such as sending and receiving files. A null modem is also known as a crossover cable.

16. Write the difference between bit rate and baud rate.

Parameters	Baud Rate	Bit Rate
Basics	The Baud rate refers to the total number of signal units transmitted in one second.	The Bit rate refers to the total Bits transmitted in one unit time.
Meaning	Baud rate indicates the total number of times the overall state of a given signal changes/ alters.	Bit rate indicates the total bits that travel per second.

17. Write the general components of data acquisition system

All data acquisition systems consist of three essential elements – Sensor, Signal Conditioning, and Analog-to-Digital Converter (ADC).

18. What is the purpose of transducer calibration system in automotive application?

Regular transducer calibration is an essential requirement for maintaining the accuracy, reliability and repeatability of the results obtained from a measurement system.

19. What are Sensors used for monitoring?

Monitoring technologies use sensors to monitor an environment, often collecting data about the environment. Control technologies use sensors to automatically control elements of a system, or a whole system, by using the data from them to trigger an action or event. The type of sensors used for real-time monitoring and control for machining and surface finishing processes are acoustic emission sensor, accelerometer, force sensor, and dynamometer/power meter. These 4 sensors are common because they measure the variables involved directly in the processes.

20. List the Fuzzy logic applications.

- Altitude control of spacecraft
- Intelligent highway systems
- Traffic control
- Air conditioning systems
- Washing machine timing

- Microwave ovens etc.,

#### 21. Define Actuators.

An actuator is a device that uses a form of power to convert a control signal into mechanical motion. From electric door locks in automobiles, to ailerons on aircraft, actuators are all around us. Industrial plants use actuators to operate valves, dampers, fluid couplings, and other devices used in industrial process control. The industrial actuator can use air, hydraulic fluid, or electricity for motive power. These are referred to as pneumatic, electro-hydraulic, or electric actuators.

#### 22. Define Artificial intelligence.

The term "Artificial Intelligence" refers to the simulation of human intelligence processes by machines, especially computer systems. It also includes Expert systems, voice recognition, machine vision, and natural language processing (NLP).