

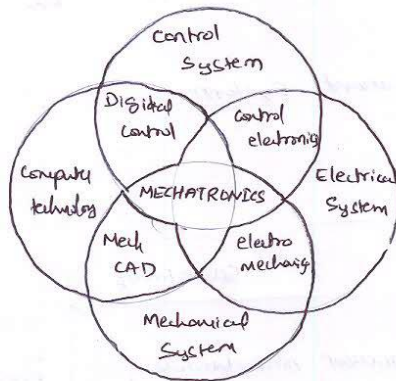
MECHATRONICS & MICRO PROCESSORS - LOMEES

Note: Answer any five questions:

- I. Define mechatronics. Explain the differences between conventional approach and mechatronics approach to product design.

Mechatronics is the complete integration or adoption of electrical, computer technology and control engineering with mechanical engineering.

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With traditional or conventional approach the mechanical engineers will design the mechanical elements then control engineers to come along and design the control system. This is termed as sequential approach. The basis of mechatronics approach is considered to lie in the concurrent inclusion of the disciplines of

mechanical engineering, electronics, computer technology and control engineering in the approach to design.

Explanation of the same with an example.

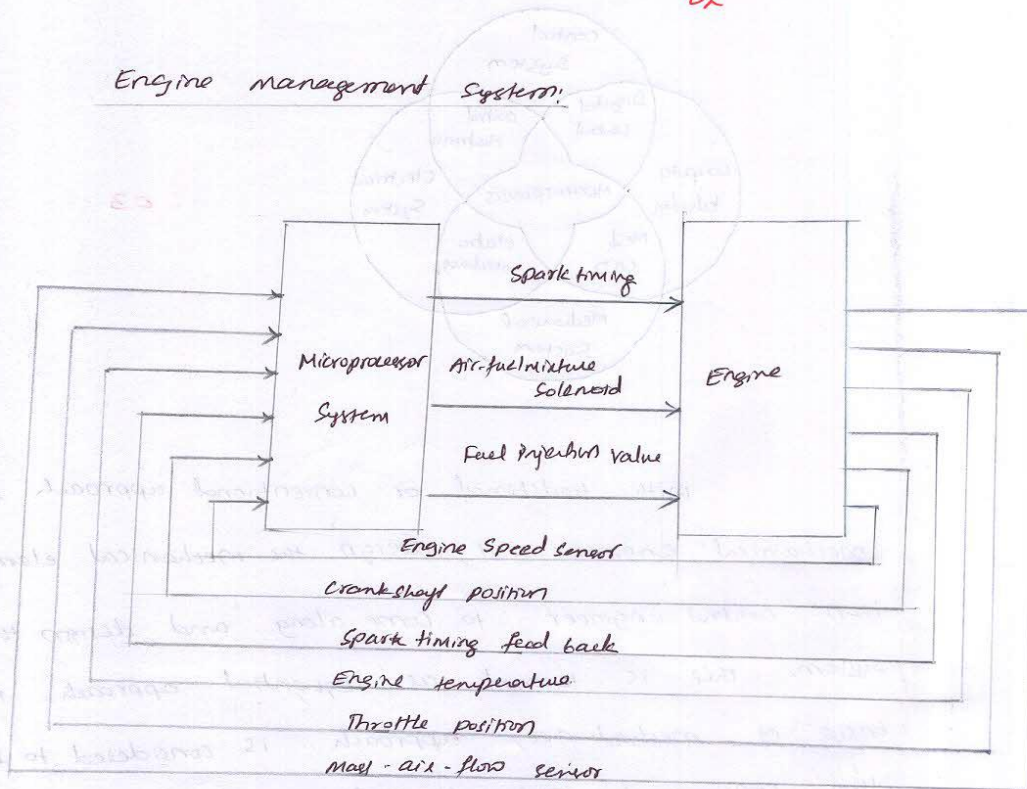
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2. Define Sequential controllers Explain with a block diagram the working of EMS.

The term sequential control is used when control is such that actions are strictly ordered in a time or event driven sequence. In sequential control system, microprocessor replaces the mechanical systems and the sequencing will be obtained by means of a software program.

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Engine management System:



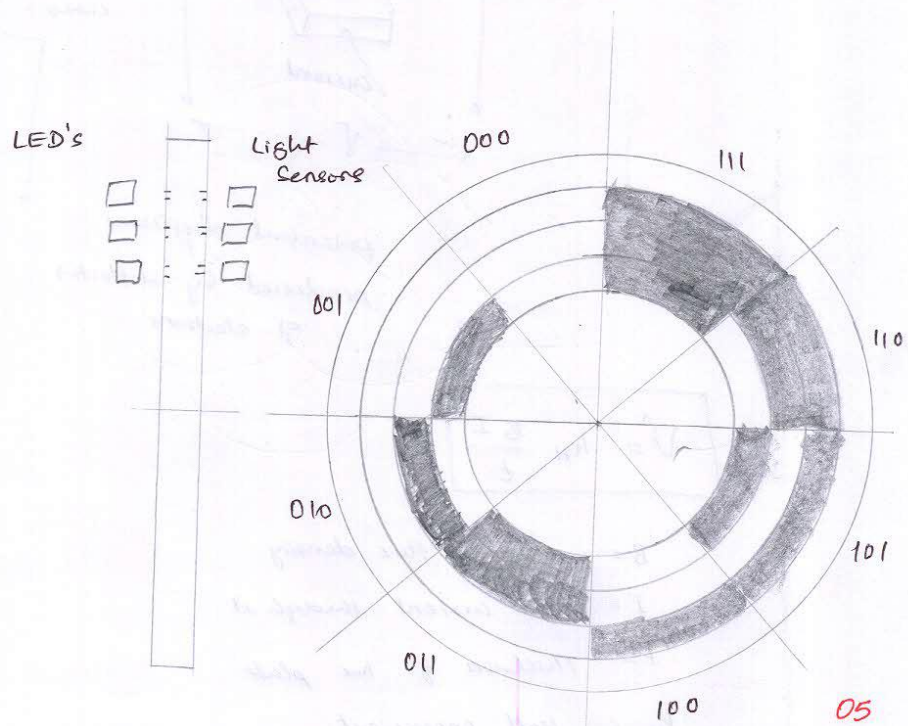
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The engine management system of a car is responsible for managing the ignition and fuelling requirements of the engine. The power and speed of the engine are controlled by varying the ignition timing and air fuel mixture.

Explain all the sensors how it is responsible for controlling the EMS. 03

3. With a neat diagram, explain how angular position is determined in case of an absolute optical encoder.

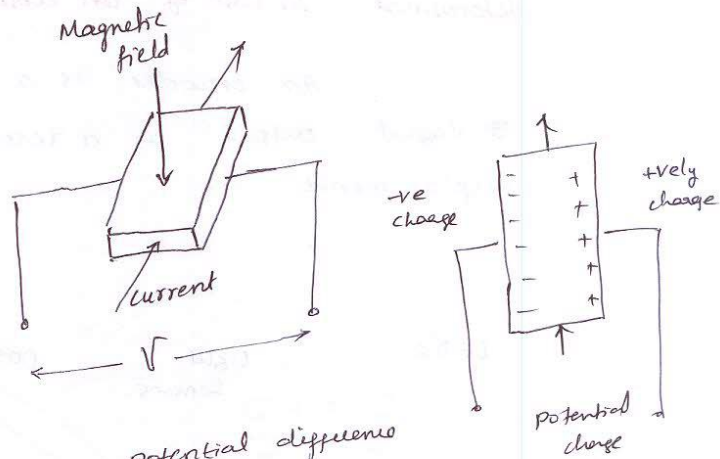
An encoder is a device that provides a digital output as a result of linear or angular displacements. 02



absolute encoder gives an output in the form of a binary number of several digits each such number represents a particular position. 03

4. Explain the working of Hall effect sensor with an example.

When a beam of charged particles passes through a magnetic field, forces act on the particles and the beam is deflected from its straight line path. A current flowing in a conductor is like a beam of moving charges and thus can be deflected by a magnetic field.



Potential difference produced by deflection of electrons.

$$V = k_H \frac{BI}{t}$$

$B$  = magnetic flux density

$I$  = The current through it

$t$  = Thickness of the plate

$k_H$  = Hall coefficient.

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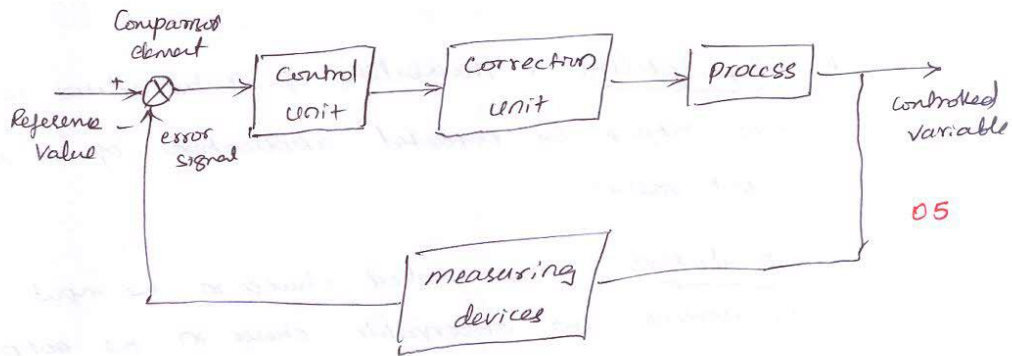


5. Explain the following performance terminologies.

$$0.2 \times 5 = 10$$

- a. Accuracy is the extent to which the value indicated by a measurement system might be wrong.
- b. Repeatability: The ability of a transducer to give the same output for repeated applications of the same input values.
- c. Resolution: The smallest change in the input value that will produce an observable change in the output.
- d. Hysteresis error.  
 Transducers can give different outputs from the same value of quantity being measured according to whether that value has been reached by a continuously increasing change or a continuously decreasing change. This effect is called as hysteresis error.
- e. Stability: Ability of a transducer to give the same output when used to measure a constant input over a period of time.
- f. The term drift is used to describe the change in output that occurs over a time.
- g. Dead band of a transducer is the range of input values for which there is no output.

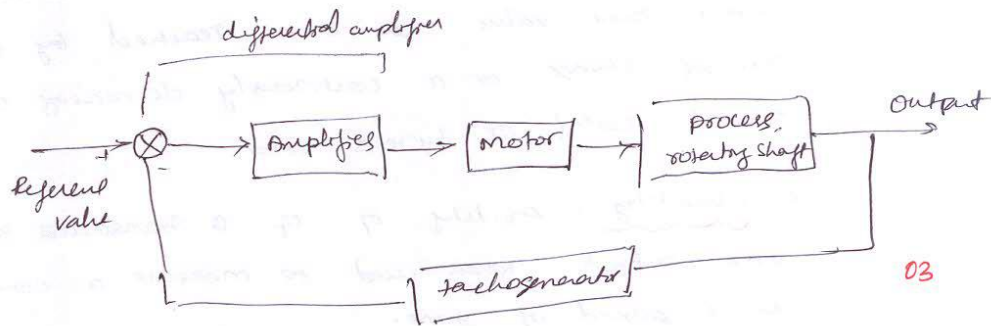
6. With a block diagram explain the basic elements of a closed loop system. Explain a simple automatic control system for the speed of rotation of shaft.



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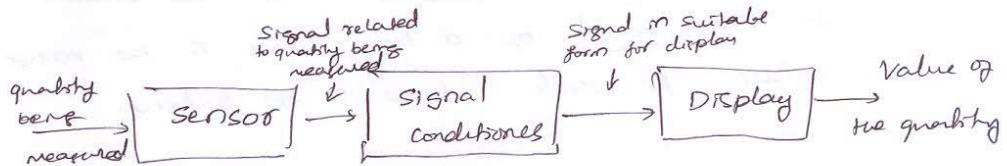
Explain all the elements with an example

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7. With a block diagram explain the basic elements of a closed loop system. Identify different elements in the measurement systems of a thermocouple.

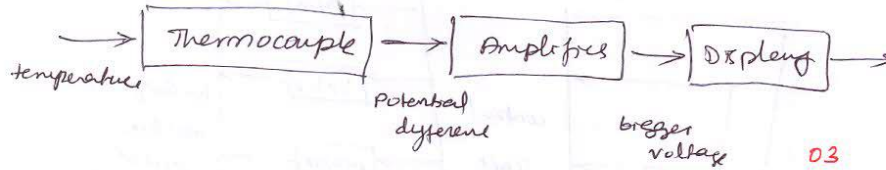


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explanation of two basic elements. 03

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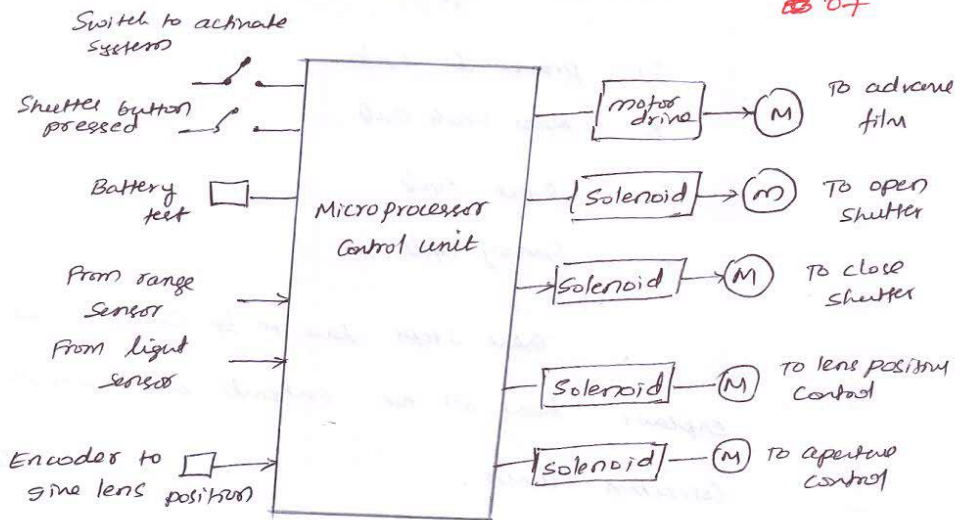
Ex: Thermocouple:



8. Explain how microprocessor controls the working of any one of the following with a neat block diagram.

a. Automatic camera. b. Washing machine

a. Automatic camera.

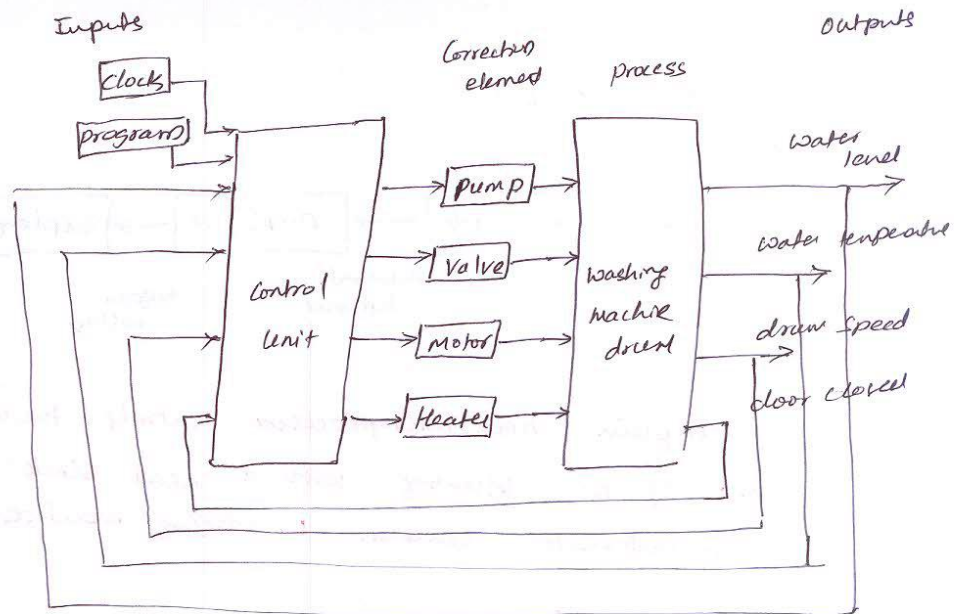


Explanation of how sensors and actuators work from the control unit.

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## 6. washing machine



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There are different steps involved in a washing machine

1. pre-wash cycle.
2. Main wash cycle
3. Rinse cycle
4. Spinning cycle.

These steps have to be carried out in a sequence.

Explain how all the outputs are controlled using correction units.

04.

*with feedback*