ROLL NO. | | | | | | | | | | |

Internal Assessment Test I

Sub:	Mechatronics					Sub Code:	18ME744/ 17ME753	Branch:	ME
Date:	12/11/2021	Duration:	90 min’s	Max Marks:	50	Sem / Sec:	A - B		OBE

	Answer any Five Questions	MARKS	CO	RBT
1	In detail explain INTEL 8085A processor architecture with a sketch.	10	CO1	L2
2	Define & compare between a sensor and transducer and draw a block diagram for the same.	10	CO1	L2
3	Explain a control of an automatic washing machine with a sketch using a microcontroller.	10	CO1	L1
4	Explain: a) capacitive proximity sensor b) hall effect sensor in detail.	10	CO2	L2
5	Explain a) ALU b) Register c) Accumulator d) Timing and control unit e) carry flag	10	CO2	L1,
6	Explain the sensors used to achieve capacity control, door automation and load control in an elevator.	10	CO2	L2

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SCHEME: Internal Assessment Test I

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Date:	12/11/2021	Duration:	90 min's	Max Marks:	50	Sem / Sec:	A - B		OBE

	Answer any Five Questions	MARKS	CO	RBT
1	In detail explain INTEL 8085A processor architecture with a sketch. **Sketch: 4 marks** **Explanation: 6 marks**	10	CO2	L2
2	Define and compare between a sensor and transducer and draw a block diagram for the same. **Define: 2** **Difference: 6** **Diagram: 2**	10	CO1	L1,L2
3	Explain a control of an automatic washing machine with a sketch using a microcontroller. **Sketch: 4 marks** **Explanation: 6 marks**	10	CO1	L2
4	Explain: a) capacitive proximity sensor b) hall effect sensor in detail. **Sketch: 2;2 marks** **Explanation: 3;3 marks**	10	CO1	L2
5	Explain the following: ALU b) Register c) Accumulator d) Timing and control unit e) carry flag **Define: 2 marks each**	10	CO2	L1, L2
6	Explain the sensors used to achieve capacity control, door automation and load control in an elevator. **Sketch: 4 marks** **Explanation: 6 marks**	10	CO2	L2

SOLUTION : Internal Assessment Test I

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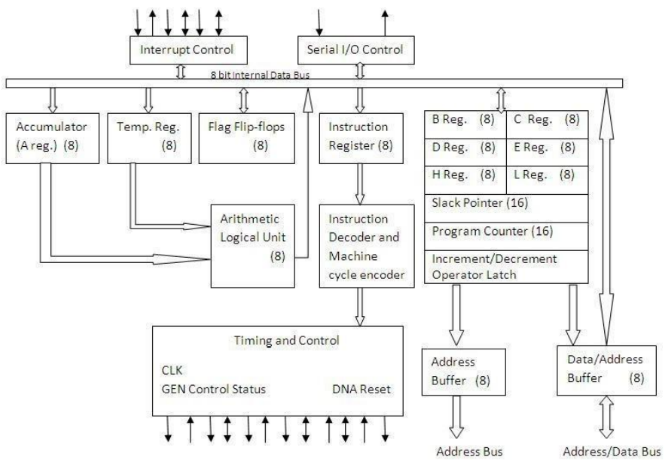
1) 8085 Microprocessor consists of six registers, one accumulator and a flag register. The typical architecture is shown in figure 6. There are six general-purpose registers B, C, D, E, H, and L, each having capacity to store 8 bit data. They are combined as BC, DE, HL to perform 16 bit operations. In addition to this Register array, two 16 bit registers viz. stack register and program counter are provided. As discussed in the earlier lecture, the „program counter" is employed to sequence the execution of instructions. It always points to the memory address from which the next byte is to be fetched. Stack Pointer points to the memory location in R/W (Read and/or write) memory. It is also termed as a „stack".Accumulator The accumulator is 8-bit register (can store 8 bit data). It is a part of arithmetic/logic unit (ALU). In general, after performing logical or arithmetical operations, result is stored in accumulator. Accumulator is also identified as Register A. Flags ALU of 8085 have five flip flops whose states (set/reset) are determined by the result data of other registers and accumulator. They are called as Zero, Carry, Sign, Parity and Auxiliary-Carry flags. A Zero Flag (Z): When an arithmetic operation results in zero, the flip-flop called the Zero flag - which is set to one. B Carry flag (CY): After an addition of two numbers, if the sum in the accumulator is larger than eight bits, then the flip-flop uses to indicate a carry called the Carry flag – which is set to one. C S-Sign (S): It is set to 1, if bit D7 of the result = 1; otherwise reset. D7 is the first digit of a binary number. D7 D6 D5 D4 D3 D2 D1 D0 S Z AC P CY A P-Parity (P): If the result has an even number of 1s, the flag is set to 1; for an odd number of 1s the flag is reset. B AC-Auxiliary Carry (AC): In an arithmetic operation, when a carry is generated by digit D3 and passed to digit D4, the AC flag is set. Generally this flag is used internally for Binary Coded Decimals (BCD). Figure 3.2.2 shows a 8-bit flag register, adjacent to the accumulator. It is not used as a register. Out of eight bit-positions, five positions are used to store the outputs of five flipflops. These flags play an important role in decision-making process of the microprocessor. Instruction Register/Decoder Before execution of an instruction, it is sent to the Instruction Register. Instruction register stores current instruction of any program. Decoder takes the instruction from memory, decodes it and then passes it to the next stage. 16 Memory Address Register Memory Address Register (MAR) holds the address of next instruction to be executed. Control Generator In microprocessor, the Control Generator generates a signal that executes the operations in accordance to the decoded instructions. In fact it creates a signal (information) which have details about connections between different blocks of the microprocessor so that data reaches to the respective place. Register Selector Register selector is basically a logical controller which directs switching between different registers of microprocessor. General Purpose Registers Microprocessor has few extra registers which can be used to store additional data during a program.



2) Sensors are defined as a device which is used to measure a physical quality - for example - light, sound, temperature etc. and give the output in an easy to read format for the user. The terms “Sensor” and “Transducer” are often used to describe the same devices; “linear sensor” and “linear transducer” refer to the same component, this is not necessarily incorrect terminology. However, in some cases “sensor” and “transducer” have different meanings and there are some differences between the two terms.

The main difference between a sensor and a transducer is the output signal. Both a sensor and a transducer are used to sense a change within the environment they are surrounded by or an object they are attached to, but, a sensor will give an output in the same format and a transducer will convert the measurement into an electrical signal.

Characteristics of a sensor

Sensors are defined as a device which is used to measure a physical quality - for example - light, sound, temperature etc. and give the output in an easy to read format for the user.

For example a mercury thermometer; the mercury simply expands when the temperature rises to give a reading for the user, there are no electrical inferences or changes. A thermistor also simply responds to the change in resistance due to the temperature change.

Characteristics of a transducer

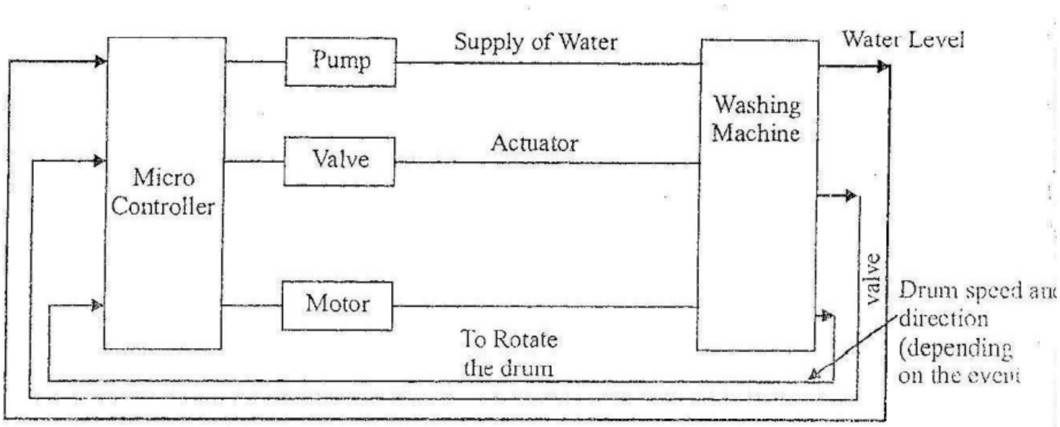
A transducer can measure similar qualities to a sensor but will convert the signal from one physical form to another meaning their input and output signals are not the same as each other. Transducers are sometimes referred to as energy converters.

There are different types of transducers; input transducers and output transducers. An input transducer takes a form of energy and converts it into an electrical signal. An output transducer takes electricity and converts it into another form of energy - for example a light bulb takes electricity and converts it to light, or a motor converting electricity to motion.

	Sensor	**Transducer**
Definition/ Function	Senses the change and gives readings in the same format that the signals are received. An additional device will be needed to convert the energy should this be required.	Senses a change, transforms the energy from one form to another. Usually from non-electrical to electrical or vice versa.
Examples	Pressure switch, thermistors, mercury thermometers, motion sensors.	Pressure transducer, cable extension transducer, linear transducer, microphone
Applications	Infrared toilet flushes, pressure level in oxygen tanks, patient monitoring.	Engine controls, HVAC monitoring, steering systems on vehicles, ramp or bridge lifting or positioning.

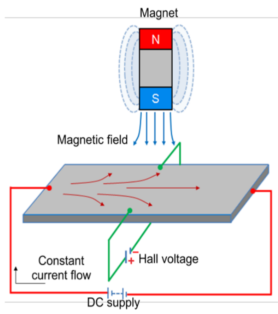
3) This is a sequential control system wherein control is exercised based on event, or parameter etc., 17 i.e., control action will be executed one after another event. The events to be carried out in a domestic washing machine are soaking, washing, rinsing and drying. Each of these operations involves a number of steps. Soaking involves selection of correct quantity of detergent and water based on the type and amount of cloth. This requires opening of the valve to fill the machine drum to required level and closing the valve once the required level of water has reached and rotating the drum in either direction for a pre-set amount of time during the soaking operation. This is followed by washing which is a time parameter event. Then the rinsing event which measures the pH value using a chemical sensor of water in the drum and compares it with supply of water. This event continues till the pH value of the water in the cloth and the supply water are equal. Finally drying operation till the minimum percentage of moisture is retained in the cloth. All these events were earlier controlled with the help of a mechanical system involving aset of cam operated switches. In modern washing machines mechanical systems are replaced by digital devices. i.e., a microcontroller and the sequence of instruction; program embedded in the microcontrollers. The amount of detergent, amount of water, pH value are all sensed by the sensor and these sensed qualities are input to the microcontroller. Based on the input and the software embedded, the corresponding output of the microcontroller to carry out the different sequence of operations.

Block diagram of a microprocessor based processor control system of Automatic washing machine:



4) Below shows the principle of working of Hall effect sensor. Hall effect sensors work on the principle that when a beam of charge particles passes through a magnetic field, forces act on the particles and the current beam is deflected from its straight line path. Thus one side of the disc will become negatively charged and the other side will be of positive charge. This charge separation generates a potential difference which is the measure of distance of magnetic field from the disc carrying current. The typical application of Hall effect sensor is the measurement of fluid level in a container. The container comprises of a float with a permanent magnet attached at its top. An electric circuit with a current carrying disc is mounted in the casing. When the fluid level increases, the magnet will come close to the disc and a potential difference generates. This voltage triggers a switch to stop the fluid to come inside the container. These sensors are used for the measurement of displacement and the detection of position of an object. Hall effect sensors need necessary signal conditioning circuitry. They can be operated at 100 kHz. Their non-contact nature of operation, good immunity to environment contaminants and ability to sustain in severe conditions make them quite popular in industrial automation.

Hall effect sensor



5)Explain the following:

a) ALU:ALU stands for Arithmetical Logical Unit. As name indicates it has two parts: Arithmetical unit which is responsible for mathematical operations like addition, subtraction, multiplication and division, Logical unit which is dedicated to take logical decisions like greater than, less than, equal to, not equal to etc. (Basically AND/OR/NOT Operations)

Register: A register is a temporary storage area built into a CPU. Some registers are used internally and cannot be accessed outside the processor, while others are user-accessible.

Accumulator: Register A is quite often called as an Accumulator. An accumulator is a register for short-term, intermediate storage of arithmetic and logic data in a computer's CPU (Central Processing Unit).In an arithmetic operation involving two operands, one operand has to be in this register. And the result of the arithmetic operation will be stored or accumulated in this register.

Timing and control: This part of CPU is dedicated to coordinate data flow and signal flow through various types of buses i.e. Data Bus, Control Bus, and Address Bus etc. It directs data flow between CPU and storage and I/O devices.

carry flag : Indicates whether there is a carry or no carry after Arithmetic operation

6)

Inductive proximity switches are basically used for detection of metallic objects. Figure 2.3.2 shows the construction of inductive proximity switch. An inductive proximity sensor has four components; the coil, oscillator, detection circuit and output circuit. An alternating current is supplied to the coil which generates a magnetic field. When, a metal object comes closer to the end of the coil, inductance of the coil changes. This is continuously monitored by a circuit which triggers a switch when a preset value of inductance change is occurred. Applications of inductive proximity switches • Industrial automation: counting of products during production or transfer • Security: detection of metal objects, arms, land mines

A load cell (or loadcell) is a transducer which converts force into a measurable electrical output. Although there are many varieties of force sensors, strain gauge load cells are the most commonly used type.

Except for certain laboratories where precision mechanical balances are still used, strain gauge load cells dominate the weighing industry. Pneumatic load cells are sometimes used where intrinsic safety and hygiene are desired, and hydraulic load cells are considered in remote locations, as they do not require a power supply. Strain gauge load cells offer accuracies from within 0.03% to 0.25% full scale and are suitable for almost all industrial applications.

A load cell works by converting mechanical force into digital values that the user can read and record. The inner working of a load cell differs based on the load cell that you choose. There are hydraulic load cells, pneumatic load cells, and strain gauge load cells. Strain gauge load sensors are the most commonly used among the three. Strain gauge load cells contain strain gauges within them that send up voltage irregularities when under load. The degree of voltage change is covered to digital reading as weight.