MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING
(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)
ISO 9001:2015 Certified by IRQS NABCB QM 006

ME8791 MECHATRONICS L T P C 3 0 0 3

OBJECTIVES: To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION 12

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II MICROPROCESSOR AND MICROCONTROLLER 10

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 8

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 7

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 8

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TOTAL : 45

TEXT BOOKS:

1. Bolton, “Mechatronics”, Printice Hall, 2008
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085” 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, “Introduction to Mechatronics and Measurement systems”, McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
3. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
4. Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.
5. Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007. 6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

C402.1	To impart knowledge about the elements and techniques involved in Mechatronics system
C402.2	To understand the emerging field of automation.
C402.3	To design mechatronics system with the help of Microprocessor
C402.4	To design mechatronics system with the help of Microprocessor
C402.5	To design mechatronics system with other electrical and Electronics Circuits

MAPPING BETWEEN CO, PO AND PSO WITH CORRELATION LEVEL 1/2/3

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PSO	PSO	PSO
ME6702	1	2	3	4	5	6	7	8	9	10	1	2	1	2	3
C402.1	3	-	2	3	1	3	3	1	2	2	2	3	1	2	2
C402.2	3	-	1	3	2	3	3	1	2	2	3	3	3	2	3
C402.3	3	-	3	3	2	1	2	-	1	2	2	2	2	2	1
C402.4	3	1	3	3	3	1	2	-	1	2	2	2	2	2	2
C402.5	3	1	3	3	3	2	2	-	2	2	3	2	2	2	2

RELATION BETWEEN COURSE CONTENT WITH Cos

UNIT I INTRODUCTION

S.No	Knowledge level	Topics	Course Outcomes
1.	U,Ap	Introduction to Mechatronics ,Systems ,Concepts of Mechatronics approach	C702.1
2.	R,U,Ap	Need for Mechatronics ,Emerging areas of Mechatronics	C702.2
3.	U,Ap,An	Classification of Sensors and Transducers	C702.1
4.	U,Ap,An	Static and dynamic Characteristics of Sensor	C702.5
5.	U,Ap,An	Potentiometers, LVDT , Capacitance Sensors, Strain gauges	C702.5
6.	U,Ap,An	Eddy current sensor , Hall effect sensor, Temperature sensors, Light Sensors	C702.5

UNIT II MICROPROCESSOR AND MICROCONTROLLER

S.No	Knowledge level	Topics	Course Outcomes
1.	U	Introduction	C702.3
2.	R,U,Ap	Architecture of 8085 and Pin Configuration	C702.3
3.	U,An	Addressing Modes Instruction set, Timing diagram of 8085	C702.3
4.	R,U,An	Concepts of 8051 microcontroller – Block diagram	C702.5

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE

S.No	Knowledge level	Topics	Course Outcomes
1.	R,U	Introduction and Architecture of 8255	C702.5
2.	R,U,Ap	Keyboard interfacing	C702.5
3.	R,U,Ap	LED display and interfacing	C702.5
4.	R,U,Ap	ADC and DAC interface	C702.5
5.	U,Ap,An	Temperature Control	C702.5
6.	U, Ap,An	Stepper Motor Control, Traffic Control interface	C702.5

UNIT IV PROGRAMMABLE LOGIC CONTROLLER

S.No	Knowledge level	Topics	Course Outcomes
1.	R,U	Introduction, Basic structure of PLC	C702.4
2.	U,Ap,An	Input and output processing	C702.4
3.	U,Ap,An	Programming and Mnemonics	C702.4
4.	U,Ap,An	Timers, counters and internal relays	C702.4
5.	U,Ap,An	Data handling, Selection of PLC.	C702.4

UINIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

S.No	Knowledge level	Topics	Course Outcomes
1.	R,U,An	Stepper motors Construction , Working Principle ,Advantages and Disadvantages	C702.5
2.	R,U,An	Servo motors Construction, Working Principle, Advantages and Disadvantages.	C702.5
3.	R,U,An	Design process-stages of design process ,Traditional and	C702.5
		Mechatronics design concepts	
4.	U,Ap,An	Case studies of Mechatronics systems. Pick and place Robot	C702.5
5.	U,Ap,An	Engine Management system	C702.5
6.	U,Ap,An	Automatic car park barrier	C702.5

R-Remembrance, Ap – Apply; An – Analyze; U – Understand, E- Evaluate, C-Create

UNIT – I

INTRODUCTION

PART-A

1. Define Mechatronics. [Nov/Dec 2017]

The term Mechatronics is used for the integration of microprocessor based control system, electrical systems and mechanical systems. Mechatronics is defined as the integration of precision mechanical & electronic control or the development of smart products & process.

2. What are the components in a Mechatronics system?[Nov/Dec2013/15][Apr/May 2018]

The Mechatronics system consists of - 1. Actuators, 2. Sensors, 3. Input signal conditioning and interfacing,4. Digital control architectures, 5. Output signal conditioning and interfacing and 6. Graphical displays.

3. What are the various elements of a closed loop system for a person controlling the temperature?

The various elements of a closed loop system are,

- Controlled variable
- Comparison element
- Error signal
- Control unit
- Measuring device

For example,

Controlled variable - The room temperature Reference value (The required room temperature)
Comparison element - The measured value compared with the required value of temperature.
Error signal - The difference between the measured and required temperatures Control unit - The person
Correction unit - The switch on the fire Process - The heating by the fire measuring device - A thermometer

4. Distinguish between open-loop and closed loop system. [Nov/Dec 2007/14]

S.No.	Open-loop	Closed-loop
1.	It does not use a feedback to control the operation of the system	Closed loop operation uses a negative feedback
2.	The effects of known disturbances alone can be countered	The effects of disturbances are countered by virtue of negative feedback
3.	Less accurate	More accurate
4.	Simple in construction	Complicated in construction
5.	Slow response because of manual Control	Closed loop can perform a task faster than open-loop

5. List some of the applications of Mechatronics?

- Home Appliances: Washing machine, Bread machines etc
- Automobile: Electrical fuel injection, Antilock brake system
- Aircraft: Flight control, Navigation system
- Automated Manufacturing

6. What are the two types of feedback loop?

The two types of feedback loop are,

- Positive feedback loop
- Negative feedback loop.

The feedback is said to be negative/positive feedback when the signal; which is feedback, subtracts/adds from the input value. It is required to control a system. The control elements decide what action to take when it receives an error signal"

7. Define Bimetallic Strips. [Nov/Dec 2016]

A temperature-sensitive electrical contact used in some thermostats, consisting of two bands of different metals joined lengthwise. When heated, the metals expand at different rates, causing the strip to bend.

8. Write an example for a transducer and state its transduction principle.[Apr/May 2018]

Transducer is a device which converts an input of one form of energy (pressure, temperature, displacement, force, etc.) into an output of another form of energy (mechanical, electrical, magnetic, etc.). For example, thermocouple is a transducer which converts change in temperature into a voltage.

9. State the advantages of capacitive type proximity sensor. [April/May 2012]

The advantages of capacitive type proximity sensor are:

- The system responds to average displacement of a large area in a moving electrode
- Excellent linearity over entire dynamic range when area is changed
- Capacitors are noiseless
- High accuracy, sensitivity and resolution

10. What is meant by RTD? State its applications. [Nov/Dec 2011]

Resistance Temperature Detector (RTD) is a resistance thermometer which is used to measure temperature by correlating the resistance of the RTD element with temperature.

- Precision process temperature control (Textile, chemical, food, brewing)
- Automatic temperature control (Test chambers, oven temperature, plastic extruders)

11. Distinguish between measurement system and control system. [Nov/Dec 2010]

S.No	Measurement system	Control system
1.	A measurement system involves the precise measurement and display / recording of physical, chemical, mechanical, electrical or optical parameters.	A control system in mechatronics refers to a group of physical component connected or related in such a manner as to command direct or regulate itself or another system

2.	Various elements of a measurement system are sensor or transducer, signal processor, display or recording device.	Several elements of a control system are reference variable, output, feedback, comparison element, correction element.

12. State the application of position and proximity sensor. [April/May 2010]

The applications of position sensor are

- IC engine ignition system timing
- Brushless DC motors to detect the position of permanent magnet
- Detection of moving parts
- Indexing of rotational or translational motion

The applications of proximity sensor are

- Computer mouse buttons and arcade game joysticks
- Door and window closure sensors in security applications

13. What is the role of control system in Mechatronics system? [Nov/Dec2013]

A control system is used to control the output value by comparing it with the desired set value. If there is an error, then it will be corrected ad now output value will be compared with the desired set value and this will be repeated until there is no error. As the control system is a part of Mechatronics system, it sequence and execute the tasks properly.

14. Define – Hysteresis [Nov/Dec 2009]

It is defined as the maximum differences in output for a given input when its value approached from the opposite direction. It is a phenomenon which shows different outputs when loading and unloading.

15. What is the working principle of an eddy current proximity sensor?

It detects the presence of a target by sensing the magnetic fields generated by a reference coil. An eddy current is a local electric current induced in a conductive material by the magnetic field produced by the sensor or active coil. This is sensed by a reference coil to create an output signal. When the distance between the target and the probe changes, the impedance of the coil changes. This change in impedance can be detected by a bridge circuit.

16. Write the working principle of Capacitive sensor. [Nov/Dec 2018]

Noncontact capacitive sensors work by measuring changes in an electrical property called capacitance. Capacitance describes how two conductive objects with a space between them respond to a voltage difference applied to them. When a voltage is applied to the conductors, an electric field is created between them causing positive and negative charges to collect on each object .If the polarity of the voltage is reversed, the charges will also reverse.

17. Write two factors that need to be considered in selecting a sensor for a particular application. [April/May 2008]

i. Accuracy required: It is difference between the measured value and the true value. Accuracy of the sensor should be as high as possible.

ii. Precision: It is the ability to reproduce repeatedly with a given accuracy. It should be very high. Error between sensed and actual value should approach zero.

iii. Sensitivity: It is the ratio of change in output to a unit change of the input.

18. What is meant by signal conditioning? [Nov/Dec 2007]

A signal conditioning means manipulating an analog signal in such a way that it meets the requirements of the next stage for further processing. It performs filtering and amplification functions.

19. Define response time and time constant based on sensors. [Nov/Dec 2018]

The response time of pressure sensors is reflected in a large number of varying parameters, such as the response time, settling time or rise time in specifications or data sheets. In general, it can be assumed that the response time is defined as the interval required by the output signal of a pressure sensor to display a change in the applied pressure.

The time constant is defined as the time required by a sensor to reach 63.2% of a step change in temperature under a specified set of conditions.

20. Define – Gauge factor [Nov/Dec 2010]

Gauge factor is the ratio of changes of the resistance per unit resistance to the strain.

Gauge factor (GF) or **strain factor** of a strain gauge is the ratio of relative change in electrical resistance R, to the mechanical strain ε. The gauge factor is defined as:

$$GF = \frac{\frac{\Delta R}{R}}{\frac{\Delta L}{L}} = \frac{\frac{\Delta R}{R}}{\varepsilon}$$

$$\varepsilon = Strain$$

GF=change in resistance/(resistance *strain)

Where ε = strain = ΔL/L

- ΔL = absolute change in length
- L= original length
- ν = Poisson's ratio
- ρ = Resistivity
- ΔR = change in strain gauge resistance
- R = unstrained resistance of strain gauge

21. What is the function of Signal Conditioner? [Nov/ Dec 2012]

A signal conditioner is a device that converts one type of electronic signal into a another type of signal. Its primary use is to convert a signal that may be difficult to read by conventional instrumentation into a more easily read format.

Signal conditioner takes the signal from the sensor and conditions the signal so that it is suitable for either display purpose (or) control purpose. For example, the emf produced by the thermocouple is very small which cannot be used for any purpose. But this emf can be amplified by sending it through amplifier.

22. Why are three concentric tracks used in an optical incremental encoder? [April/May 2010]

The incremental encoder consists of two tracks and two sensors whose outputs are called

channels A and B. As the shaft rotates, pulse train occur on these channels at a frequency proportional to the shaft speed and the phase relationship between the signals yields the direction of the rotation. Incremental encoders often have third channel called index channel with a single segment slot or reference yields one pulse per revolution which is useful in counting full revolutions. It is also useful as a reference to define a home base or zero position.

23. Define repeatability and reproducibility in sensors. [Nov/Dec 2013]

Repeatability: It is the ability of the sensor to produce same results under same measurement conditions.

Reproducibility: It is the ability of a sensor to produce same results under different measurement conditions.

24. What is the function of sensor? [April/May2017]

A sensor responds to the quantity to be measured and produces a signal (as output) related to the quantity. Example: Thermocouple-a temperature sensor. The input to the thermocouple is temperature and the output is an electromotive force (e.m.f) related to the value of temperature.

25. What is meant by Resolution? [Nov/Dec 2017]

Resolution is defined as the smallest increment in the measured value that can be detected. The resolution is the smallest change in the input value which will produce an observable change in the input. Resolution is also known as the degree of fineness with which measurements can be made.

PART B

1. Explain the emerging areas of Mechatronics system with examples.**[Nov/Dec2017] [Apr/May 2018]**

2. Explain the basic elements of closed loop control system in detail and explain it with shaft speed control with a neat block diagram. **[May/June 2013]**

3. Explain the principle of various sensors used for measuring displacement.**[Apr/May 2017]**

4.What is RTD?. Briefly explain the relationship between resistance and temperature for the RTD with temperature resistance curve. **[Nov/Dec 2014,2018]**

5.Classify transducers by function, performance and by output basis.

6. Explain an incremental encoder. What are their applications?

7. Explain the basic elements of a closed loop control system with the help of an automatic water level Controller. **[Nov/Dec 2016]**

8. Explain the static and dynamic characteristics of sensors **[Nov/ Dec 2012,2014,2016]**

9. Explain the microprocessor based controller with suitable example(automatic camera)

[**Nov/Dec 2015][Apr/May2015]**

10. Explain the Hall effect sensor, Thermocouple, MPX sensors and photodiode.

[Nov/Dec 2015/16]

11. Explain the following: Thermistors and Piezoelectric Transducer.**[Nov/Dec 2018]**

12.Explain how displacement is sensed by LVDT. With Neat sketch show how it can be made phase sensitive.(8 marks) **[May/ June 2013][Nov/Dec2017]**

13. What are applications of bimetallic strip? Discuss their types and principle of operation respectively. **[May/June 2013]**

14. Explain the working of Eddy current Proximity Sensor. **[Apr/May 2018]**

15.How is Bernoulli's principle used to measure the flow rate?(8) **[May/June 2013]**

16.Explain the working principle of automatic camera **[Nov/Dec2013]**

17.Describe neatly potentiometer sensor. (8 marks) **[Nov/Dec2013/17/18]**

18.Explain the working of pneumatic load cell and strain gauge. (8 marks) **[Nov/Dec2013/18]**

19.Explain the temperature measurement using thermocouples. **[April/May 2017]**

20.Define all the dynamic characteristics of sensor(6 marks) **.** **[Nov/Dec 2015]**

PART-C

1. A potentiometer which is used to measure the rotational position of the shaft has 850 turns of wire. The input range is from -160° to + 160°. The output range is from 0 V to 12 V. Determine (i) Span (ii) sensitivity (iii) Average resolution in volts.

2. What are applications of bimetallic strip? Discuss their types and principle of operation respectively.

3. Demonstrate the details about inductive transducer used to measure the linear displacement. **[Nov/Dec 2018]**

UNIT-II MICROPROCESSOR AND MICROCONTROLLER

PART-A

1. What is meant by microprocessor?

A microprocessor is a multipurpose, programmable, clock driven, registers –based electronic device that reads binary instructions from a storage device called memory, accepts binary data as input and processes data according to those instructions, and provides results as output.

2. What are the four components of a programmable machine?

A typical programmable machine can be represented with four components.

- ✓ Microprocessor ,Memory ,Input /Output module (peripheral ports)

3. Define - Bus

A group of lines used to transfer bits between the microprocessor and other components of the computer system.

(i) Address Bus

A group of lines that are used to send a memory address or a device address from the MPU to the memory location or the peripheral and is unidirectional. The 8085 microprocessor has 16 address lines.

(ii) Data Bus

A group of bi-directional lines used to transfer data between the MPU and peripherals and is bi-directional. The 8085 microprocessor has eight data lines.

4. What are the types of languages?

The types of languages used are,

- ✓ Machine language

- ✓ Assembly language
- ✓ Low – level language
- ✓ High – level language

5. List the different machine cycles of 8085.[Nov/Dec 2017]

- Opcode fetch
- Memory read
- Memory write
- I/O read
- I/O write
- Interrupt Acknowledge

6. What are the two parts of an instruction?

An instruction has two parts.

- ✓ Opcode – Operation to be performed.
- ✓ Operand – The operand can be data (8 – or 16 – bit), address, or register, or it can be implicit. The method of specifying and operand (directly, indirectly, etc.,) is called the addressing mode.

7. What are the types of bus?

The types of bus are,

- ✓ Address bus
- ✓ Data bus
- ✓ Control bus.

8. What is meant by 16 – bit register of 8085 microprocessor?[Nov/Dec 2018]

The 8085 has six general-purpose registers to store 8-bit data; these are identified as- B, C, D, E, H, and L. These can be combined as register pairs – BC, DE, and HL, to perform some 16-bit operation. These registers are used to store or copy temporary data, by using instructions, during the execution of the program.

The 8085 has two 16 – bit register.

- ✓ The program counter - The program counter is used to sequence the execution of a program.
- ✓ Stack pointer - The stack pointer is used as a memory pointer for the stack memory.

9. Explain the function of program counter in 8085.

The program counter contains the address of the next instruction to be executed & places it on the address bus. It sequences the program execution.

10. List four branch instructions of 8085.

JUMP (JMP 16 bit address)

CALL (CALL 16 bit address)

RETURN (RET) RESTART(RSTn)

11. What are the two types of memories?

The two types of memories are,

- ✓ Static memory (SRAM) - It is made up of flip – flops, and it sores the bit as a voltage.
- ✓ Dynamic memory (DRAM) – It is made up of MOS transistor gates and it stores the bit as a charge.

12. What are the functionalities of the READY and ALE pins in 8085.

READY: It is used by the microprocessor to sense whether a peripheral is ready or not for data transfer. If not, the processor waits. It is thus used to synchronize slower peripherals to the microprocessor.

ALE: Address Latch Enable pin is used to latch the lower half byte of address bus (A0 – A7) in 8085 microprocessor with the help of an external latch.

13. Write is meant by SRAM?

- ✓ This memory is made up of flip – flops, and it sores the bit as a voltage.
- ✓ Each memory cell requires six transistors.
- ✓ The memory chip has low density, but high speed.
- ✓ More expensive, and consumes more power.
- ✓ Also known as cache memory.

14. What are the advantages of DRAM?

The advantages of DRAM are,

- ✓ This memory is made up of MOS transistor gates and it stores the bit as a charge.
- ✓ It has high density.
- ✓ Low power consumption
- ✓ Cheaper than static memory
- ✓ Economic to use when the system memory size is at least 8K for small systems.

15. What are the disadvantages of DRAM?

The disadvantages of DRAM are,

- The charge (bit information) leaks.
- Stored information needs to be read and written again every few milliseconds this is called refreshing the memory.
- Requires extra circuitry, adding to the cost of the system.

16. What are interrupts?

Interrupts are the signals generated by the external devices to request the microprocessor to perform a task. There are 5 interrupt signals, i.e. TRAP, RST 7.5, RST 6.5, RST 5.5, and INTR.

17. What is meant by flash memory?

The flash memory must be erased either in its entirely or at the sector level. The memory chips can be erased and programmed at least a million times. The power supply requirement for programming these chips 2 was around 12V, but now chips are available that can be programmed using a power supply as low as 1.8 V. Hence, this memory is ideally suited for low – power systems.

18. What are the instructions of an 8085 instruction set for data transfer from memory to the microprocessor? [Apr/May 2018]

The 8085 instruction set includes three memory transfer instructions.

- MOV R,M : Move from Memory to Register
- LDAX B/D : Load Accumulator Indirect
- LDA 16 – bit : Load Accumulator Direct

19. What are the usage of TIMER and COUNTER?

A counter accumulates an unknown quantity of external events over a known interval of time. E.g On - delay timer, Off - delay timer

A timer accumulates a series events of a known interval over an interval that is being measured. E.g Synchronous counter, Decade counter, Up/down counter

20. What are the opcodes related to rotating the accumulator bits?

The opcodes related to rotating the accumulator bits are,

a. RLC – Rotate Accumulator Left through Carry
b. RAL – Rotate Accumulator Left
c. RRC – Rotate Accumulator Right through Carry
d. RAR – Rotate Accumulator Right

21. What is the need for D/A converter?[Nov/Dec 2017]

A **digital-to-analog converter** (**DAC**, **D/A**, **D2A**, or **D-to-A**) is a system that converts a digital signal into an analog signal. An analog-to-digital converter (ADC) performs the reverse function. There are several DAC architectures; the suitability of a DAC for a particular application is determined by figures of merit including: resolution, maximum sampling frequency and others. Digital-to-analog conversion can degrade a signal, so a DAC should be specified that has insignificant errors in terms of the application.

22. Define - RAM & ROM [Apr/May 2018]

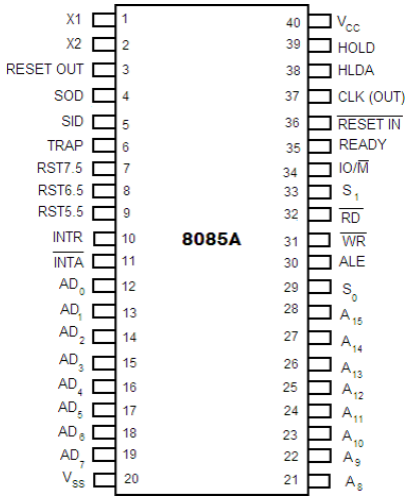
a. RAM – Random Access Memory. Data is stored in a read / write memory.

b. ROM – Read only Memory. A memory that stores binary information permanently. The information can be read from this memory but cannot be altered.

23. Name a few differences between Microprocessor and Microcontroller.[Nov/ Dec 2016]

Microprocessor	Microcontroller
1. Microprocessor is a heart of computer system	1. Microcontroller is a heart of Embedded system
2. It is just a processor. Memory and I/O components have to be connected externally	2. Microcontroller has external processor along with internal memory and I/O components
3. Microprocessors have less number of registers, hence more operations are memory based.	3. Microcontroller have more number of registers, hence programs are easier to write.
4. Mainly used in personal computers.	4. Used mainly in washing machine,MP_3 players.

24. Sketch the functional pin description of 8085.[Nov/Dec 2018]



25. What is meant by ALU? State its function. [Nov/Dec 2016]

The ALU is responsible for data manipulation and performs arithmetic and logical operations such as addition and subtraction. In addition, the ALU contains a number of control inputs, which specify the data manipulation function to be performed. ALU is combinational logic circuit, whose output is an instantaneous function of its data and control inputs.

PART – B

1. With neat diagram, explain the pin configuration of 8085.**[Apr/May 2018]**
2. Explain the 8085 architecture with neat sketch (16) **[April/May 2017/18][Nov/Dec2016/17/18]**
3. What are the functions of address and data buses. Also determine the timing diagram of the instruction MOV A,B and explain the process. **[Nov/Dec 2017]**
4. Discuss the Addressing Modes and Instruction set o 8085 microprocessor.**[April/May 2017]** **[Nov/Dec 2018]**
5. (i) Explain the data transfer instruction set in 8085. (12)

(ii) Explain the flag register of the 8085 processor. (4)

6. Explain each PORT circuitry available in 8051.
7. Explain the internal architecture of 8051 microcontroller.(16)
8. With necessary diagram of control word format, explain the different operating modes of timer in 8051 microcontroller.
9. Explain the programming model of 8051 microcontroller.
10. With a neat diagram, explain the memory organization of 8051 microcontroller(10)
11. What are interrupts available in the 8051? What are control registers available in the SFR area to control these register? Explain.
12. List the special function registers of 8051 microcontroller and explain their functions.
13. With a neat pin diagram 8051, explain the functions of each pin in detail.
14. Write briefly on arithmetic instructions of 8051
15. What is a microcontroller? Explain any one microcontroller architecture interrupt system. Describe a typical application for which it can be made use of.
16. List out the functions of following signals of INTEL 8085 Microprocessor.
    (i) READY, HOLD, HLDA, SOD.(8)
    (ii) Discuss the interrupt structure of 8085 Microprocessor.(8)

PART- C

1. Design a 8085 microprocessor system such that it should contain 2K byte of EPROM and 2K byte of RAM with starting addresses 0000H and 6000H respectively.

2. Explain the different serial communication modes of operation of 8051 microcontroller. Draw the bit pattern of program status word of 8051 and explain the significance of each bit with examples.

3. Design a schematic of interfacing I/O devices using memory mapped I/O technique with 8 DIP switches which control various relay operated processes.(DIP switches are decoded with address FFF9H and Relays are decoded with address FFF8H).

UNIT-III PROGRAMMABLE PERIPHERAL INTERFACE

PART-A

1. What are the interfacing devices?

The interfacing devices are semiconductor chips that are needed to connect peripherals to the bus system. The bus drivers increase the current driving capacity of the buses, the decoder decodes the address to identify the output port, and the latch holds data output for display. These devices are called interfacing devices.

2. How will you interface the I/O devices?

I/O devices can be interfaced using two techniques. They are,

- Peripheral – mapped I/O
- Memory – mapped I/O.

In peripheral – mapped I/O, a device is identified with an 8 – bit address and enabled by I/O related control signals

In memory mapped I/O, a device is identified with a 16-bit address and enabled by memory – related control signals.

3. What is peripheral interfacing? [April/May 2017][Nov/Dec2017]

The Peripheral Interfacing is a kind of interaction between processor and external or peripheral devices. To interface physically, a component or mediator between I/O device and processor is used which is called I/O module.

4. What is meant by A/D and D/A converter?

A/D converter is a device that converts analog signals (usually voltage) obtained from environmental (physical) phenomena into digital format Conversion involves a series of steps, including sampling, quantization, and coding.

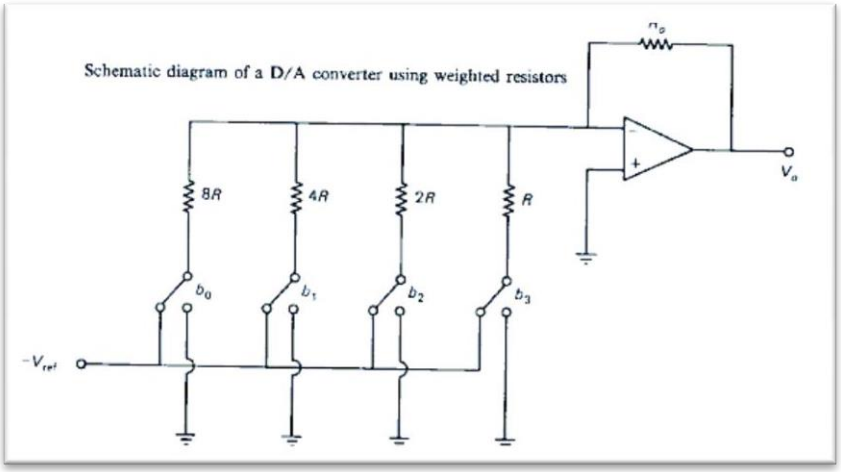
D/A converter takes a precise number (most commonly a fixed-point binary number) and converts it into a physical quantity (example: voltage or pressure). D/A converters are often used to convert finite-precision time series data to a continually varying physical signal.

5. What are the types of D/A converters?

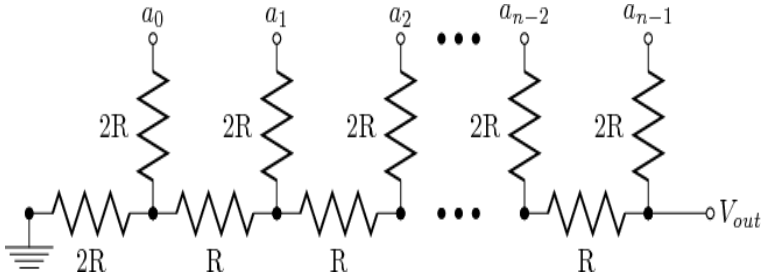
There are two types of D/A converters:

- Weighted Resistor or Resistive Divider type
- R-2R Ladder type

In the weighted resistor type D/A Converter, each digital voltage is converted into an equivalent analog voltage or current. In a 4-bit D/A converter, from 0000 to 1111, there are 15 discrete levels and hence it is convenient to divide the output analog signal into 15 discrete levels.



An R–2R Ladder is a simple and inexpensive way to perform digital-to-analog conversion, using repetitive arrangements of precise resistor networks in a ladder-like configuration. A string resistor ladder implements the non-repetitive reference network.



6. What are the elements required for D/A converter?

A D/A converter circuit require three elements. They are,

- Resistor network with appropriate weighting
- Switches
- Reference source

7. Distinguish between half duplex & full duplex transmission. [Nov/Dec-2010]

Half duplex no simultaneous both side transmission i.e though transmission &reception can be done through the same channel they can't be done simultaneously.

Full duplex no simultaneous both side transmission i.e though transmission &reception can be done through the same channel they can't be done simultaneously.

8. What are the two techniques involved in A/D conversion?

The techniques involved in A/D conversion are, comparing a given analog signal with the internally generated equivalent signal. This group includes successive approximation, counter, and flash – type converters. Changing an analog signal into time or frequency and comparing these new parameters to known values. This group includes integrator converters and voltage to frequency converters.

9. What are the applications of A/D converters?

The A/D converters are used in applications such as data loggers and instrumentation, where conversion speed is important. The integrating type converters are used in applications such as digital meters, panel meters and monitoring systems, where the conversion accuracy is critical.

10. What are the functions of a microprocessor to be interfaced with an A/D converter?

To interface an A/D converter with the microprocessor, the microprocessor should,

- Send a pulse to the 'START' pin. This can be derived from a control signal such as write (WR)
- Wait until the end of the conversion. This period can be verified either by status checking (polling) or by using the interrupt.
- Read the digital signal at an input port.

11. Mention major blocks of 8255 PPI.[April/May 2017]

- ✓ Data bus buffer
- ✓ Read/write logic
- ✓ Cascade buffer/comparator
- ✓ Control logic
- ✓ In service register (ISR)
- ✓ Priority resolver
- ✓ Interrupt request register (IRR)
- ✓ Interrupt mask register (IMR).

12. Distinguish between timers and counters. (April/May 2011)

A **counter** accumulates an unknown quantity of external events over a known interval of time. The measurement of interest is typically frequency when the events are periodic. If the events are random, the measurement involves event density over time.

A **timer** accumulates a series events of a known interval over an interval that is being measured. The measurement of interest is typically the time elapsed between two events. If the start and stop events recur periodically, multiple measurements can be made and averaged, allowing for increased resolution. Counter/timers in MPU's are typically just counters that count external events in counter mode and processor cycles in timer mode.

13. What is meant by break point?

In a single – board computer, the break point facility is a software routine that allows executing a program in sections. The break point can be set in a program by using RST instructions. When the execute key is pushed, the program will be executed until the breakpoint, where the monitor takes over again. If the segment of the program is found satisfactory, a second breakpoint can be set at a subsequent memory address to debug the next segment of the program.

14. What are the modes in which 8255 can be operate? (NOV-2011)

The two basic modes of PPI are,

a. Bit set / reset mode,
b. I/O mode.

The I/O mode is further divided into 3 modes,

- ✓ Mode 0 – simple I/O,
- ✓ Mode 1 – Handshake mode,
- ✓ Mode 2 – Bi-directional I/O.

15. What are the advantages of the break point?

- Isolate the segment of the program with errors.
- Isolated segment can be debugged with the single – step facility.
- Check out the timing loop.
- Check the I/O section
- Check the interrupts.

16. What is key debouncing? (NOV-2011)

When a key press is found, the microprocessor waits for at least 10 ms before it accepts the key as input. It is called key debouncing.

Details: When we press any switch manually and release it bounces due to inherent elasticity, this causes multiple make and break of electrical contact. If the response time is very large then it won't create any problem, but if it is small then we get multiple responses for a single key press.

17. What are the features of 8051 microcontroller? (April/May 2011)

- Inbuilt memory
- Inbuilt ADC and DAC
- Programmable with ALP and high level languages such as C

18. What is a null modem?

The crossover connection between the two data terminal equipments is often called a null modem. The TXD from the DTE – 1 sends data to the RXD input of the DTE – 2. Likewise, the TXD from

the DTE –2 sends data to the RXD input of the DTE-1. The handshake signals are also crossed over.

19. Define – PPI

8255 is a widely used, programmable, parallel I/O device. It can be programmed to transfer data under various conditions from simple I/O to interrupt I/O.

20. Distinguish between parallel data transfer and serial data transfer.[Apr/May 2018]

S.No	Parallel data transfer	Serial data transfer
1	Data is transferred as byte	Data is transferred as bit
2	More number of channels are required for data transfer	Only one channel is enough for data transfer
3	No need of parallel to serial data conversion for transmission and Reception	Needs parallel to serial data conversion for transmission and reception
4	High speed transmission	Low speed transmission

21. What are the methods used for communication in 8085.

- ✓ Serial communication
- ✓ Simplex, half duplex and full duplex communication
- ✓ Synchronous and asynchronous communication
- ✓ Parallel communication

22. What are the applications of D/A converter interfacing with 8255?

- ✓ Temperature control
- ✓ Air conditioning control
- ✓ Washing machine control
- ✓ Traffic light control

23. What is the bit set reset mode of 8255 PPI?[Apr/May 2018]

The individual bits of port C can be set or reset by sending out a single OUT instruction to the control register. When port C is used for control/ status operation, this feature can be used to set or reset individual bits.

24. What are the features of 8255?[Nov/Dec 2018]

The features of 8255 are namely.

1. The 8255A is a widely used, programmable, parallel I/O device.
2. It can be programmed to transfer data under various conditions, from simple I/O to interrupt I/O.
3. It is compatible with all Intel and most other microprocessors.
4. It is completely TTL compatible.
5. It has three 8-bit ports : Port A, Port B, and Port C, which are arranged in two groups of 12 pins. Each port has an unique address, and data can be read from or written to a port. In addition to the address assigned to the three ports, another address is assigned to the control register into which control words are written for programming the 8255 to operate in various modes.

25. What are DTE and DCE?

DTE: Terminals and computers that are sending or receiving the serial data are referred to as Data

Terminal Equipment. (DTE).

DCE: Modems and other equipment used to send serial data over long distances are known as Data Communication Equipment.(DCE).

26. State CWR of 8255?[Nov/Dec 2018]

The 8255 provides 24 parallel input/output lines with a variety of programmable operating modes. The8255 is a member of the MCS-85 Family of chips, designed by Intel for use with their 8085 and 8086 microprocessors and their descendants. It was first available in a 40-pin DIP and later a 44-pin PLCC packages.

PART – B

1. Explain the internal architecture of 8251 USART.
2. What are I/O ports, the programmable and non-programmable ports? Illustrate the control word format of PPI 8255 for the mode 1 in output configuration using its control word, control signals and statusword. **[Nov/Dec 2016]**
3. Explain with neat sketch microprocessor based Traffic light Control system by using 8255PPI. **[April / May 2017]**
4. Explain the standard I2C block diagram
5. Explain the internal architecture, operating modes and programming of 8255 PPI. **[April/May2017]**
6. Explain the mode 1 input configuration of 8255 programmable peripheral interface using its control word, control signal and status word.
7. Explain the function of major components in 8279 keyboard display controller.
8. Show and explain LED interfacing with 8255. **[Nov/Dec 2018]**
9. Explain the pin configuration, operating modes and programming of 8251 serial interface.
10. Write short notes on the following with neat figures. (a) Interfacing 8-bit ADC to 8085 microprocessor.(b)GPIB
11. Explain microprocessor based stepper motor control system by using 8255PPI **[Apr/May 2018][Nov/Dec 2016/17/18]**
12. .(a).(i).Explain the architecture of INTEL 8253 timer/counter with a neat block diagram **[Nov/Dec 2010]**
13. Explain the working of INTEL 8255 programmable peripheral interface with a neat block diagram. **[Nov/Dec 2010]**
14. With a neat sketch, explain the working of the 8279 keyboard display controller. (16)
15. With a neat sketch, explain the working of the 8255 PPI. **[April/May2011]**
16. Explain the pin description, architecture and control modes of 8255 in detail. **[Apr/May Nov/Dec 2018]**

PART-C

1. The temperature in a furnace has to be controlled using a microprocessor. Explain the arrangements with an illustration. Write an assembly language program for temperature control. **[Nov/Dec 2017]**

2. Interface ADC chip with 8085 processor through 8255 ports and write an ALP to use BSR mode

to START conversion and STATUS CHECK mode to read output data. Explain the complete circuit and programs. Use memory mapped I/O configuration

3. Describe how 8279 keyboard and display controller is interfaced to 8085.

4. Describe a traffic light controller using 8255 microprocessor. **[Nov/Dec 2018]**

UNIT-IV

PROGRAMMABLE LOGIC CONTROLLERS

PART-A

1. What is meant by PLC? [Nov/Dec 2012]

A programmable logic controller is a microprocessor based controller that uses a programmable memory to store instructions and to implement functions such as logic, sequencing, timing, counting and arithmetic in order to control machines and process.

2. What is an internal relay in a PLC? [Nov/Dec 2012]

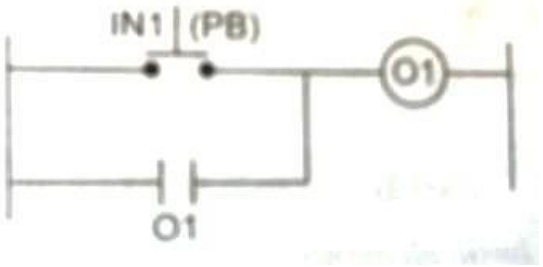
Most PLCs have an area of memory allocated for internal storage that are used to hold data which behave like relays. It is able to switch ON and OFF. But this is only for internal purpose. This will not exist in the real world.

3. What is shift register? What is the data required for a shift register? [Nov/Dec 2013]

Shift registers can be used where sequence of operations is required for movement or track the flow of parts and information.

The data required for the shift register are address of the bit array, address of the control structure, address of the source bit, number of bits in bit array.

4.Draw the general ladder rungs to represent a latch circuit.[Apr/May Nov/Dec 2018]



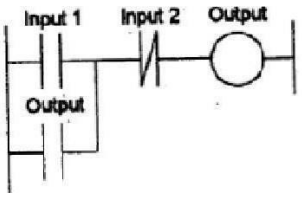
O1 – Output

IN1 – Push button

5. What are the features of programmable logic controller? [Apr/May 2015]

- They are rugged and designed to withstand vibrations, temperature, humidity and noise.
- The interfacing for inputs and outputs are inside the controller.
- They are easily programmed.

6. What is a Ladder Diagram? [Nov/Dec 2013]

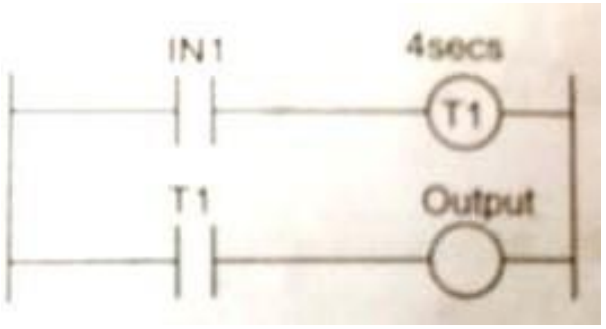


Ladder logic is a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. It is primarily used to develop software for programmable logic controllers (PLCs) used in industrial control applications.

7. Draw the ladder diagram of ON delay and OFF delay timer. [Apr/May 2008]

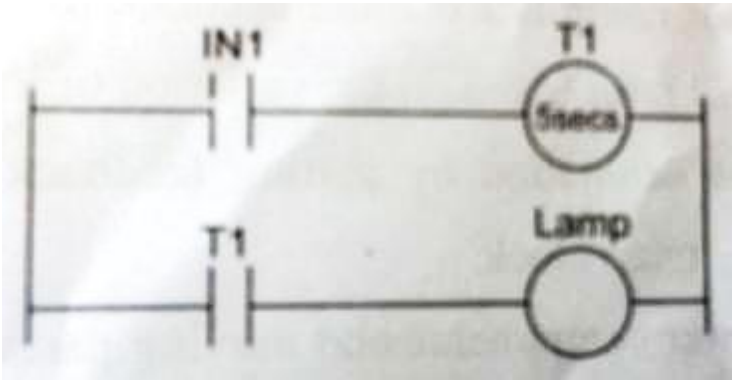
ON delay timer:

The timer is energized when the input IN1 becomes energized. The timer starts running after some present time.



OFF delay timer:

When the contact IN1 is closed, the contact will energize the timer T1 and holds the output lamp ON for specified set value of 10 seconds. The action of an OFF delay timer is to delay setting the lamp OFF.



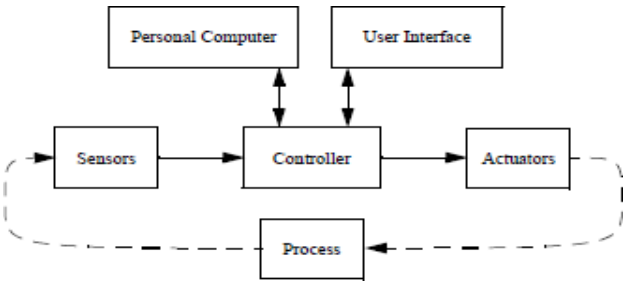
8. How does PLC differ from relay logic? [Nov/Dec 2010]

- Rewiring should be easily done in PLC.
- No vertical connections are allowed.
- In PLC, there must always be one output on each line.

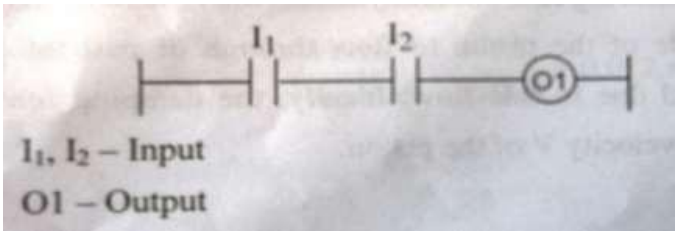
9. What is the use of JUMP control in PLC. [Nov/Dec 2010]

The JUMP instruction is an output instruction, enabling part of a ladder diagram to be jumped over. With JUMP instruction the processor scan time can be reduced by jumping over instruction not patient to the machine operation there by missing intermediate program and can skip instructions when a production fault occurs.

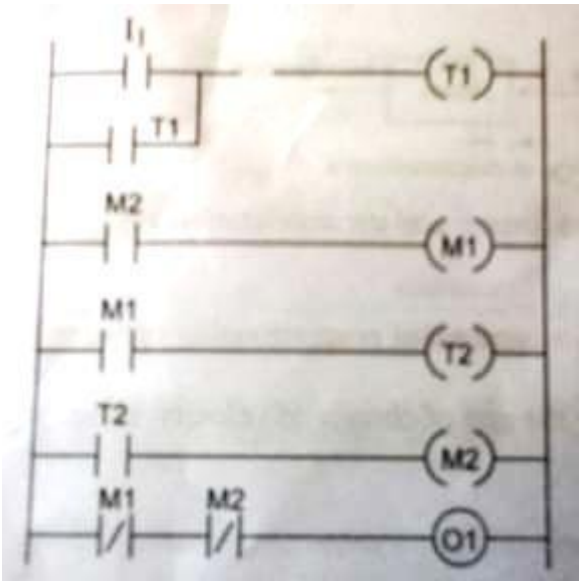
10. Draw the block diagram of PLC.



11. What are the logic functions that can be obtained by using switches in series? [Nov/Dec 2007]



12. Draw a timing circuit that will switch an output for ON for 1 sec then OFF for 20 seconds, then ON for 1 second, then OFF for 20 seconds and so on.[Apr/May 2008]

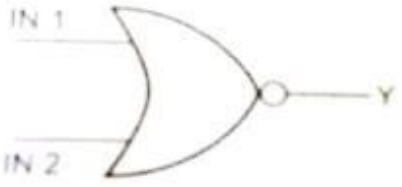


I1 – Input

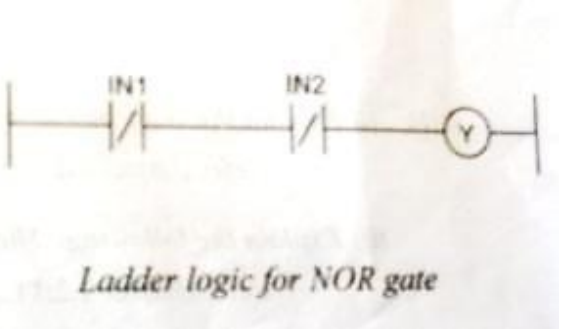
T1 – Timer 1 for 1 second T2 Timer 2 for 20 seconds

M1, M2 – Memory coil O1 – Output (light)

13. Draw NOR logic function using ladder diagram. [Apr/May 2010]



NOR gate



Ladder logic for NOR gate

14. What are the main components of PLC and describe the main function of each? (or) write short notes on the basic arrangement of a PLC system. [May/ June 2013]

CPU, Input / Output (I/O) section and programming device are the main components of PLC. CPU executes the stored user program from memory, and sends appropriate output commands to control devices. I/O section forms the interface between the field device and the controller. This section condition the various signals received from or sent to external field devices. The programming device is used to enter the desired program into the memory of the processor.

15. What are the features of PLC as a controller?

The features of PLC as a controller are,

- They are rugged and designed to withstand vibrations, temperature, humidity and noise.
- The interfacing for inputs and outputs is inside the controller.
- They are easily programmed and have an easily understood programming language.

16. Define Latch Circuit? [Nov/Dec 2016]

A flip-flop or latch is a circuit that has two stable states and can be used to store state information. A flip-flop is a bitable multi vibrator. The circuit can be made to change state by signals applied to one or more control inputs and will have one or two outputs.

17. What is meant by ladder programming?

The ladder programming involves each program task being specified as though a rung of a ladder. Thus such a rung could specify that the state of switches A and B, the inputs, be examined and if A and B are both closed then a solenoid, the output is energized.

18. What is meant by up counter?

An up counter would count up to the preset value. Events are added until the number reaches the set value. When the set value is reached the counters contact changes the state.

19. List the factors to be considered while selecting a PLC. [April/May 2017/18]

1. Number of logical inputs and outputs
2. Memory - Often 1K and up. Need is dictated by size of ladder logic program. A ladder element will take only a few bytes, and will be specified in manufacturers' documentation.
3. Number of special I/O modules - When doing some exotic applications, a large number of special add- on cards may be required.
4. Scan Time - Big programs or faster processes will require shorter scan times. And, the shorter the scan time, the higher the cost. Typical values for this are 1 microsecond per simple ladder instruction.
5. Communications - Serial and networked connections allow the PLC to be programmed. The needs are determined by the application.
6. Software - Availability of programming software and other tools determines the programming and debugging ease.

20. List the advantages of PLC system with the tradition mechanical system

Advantages of PLC system over traditional mechanical system: In PLC system, the time duration can be easily adjusted by changing the timer preset values (i.e., DATA) in the program

whereas the traditional system requires various sizes of the cams.

21. What is meant by internal relay in PLC?

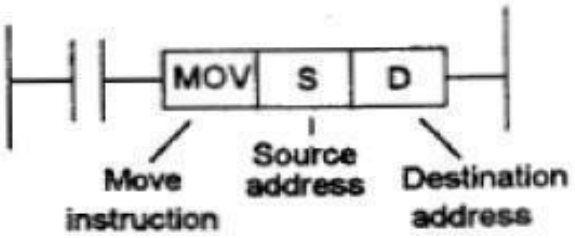
Most PLCs have an area of memory allocated for internal storage that is used to hold the data, which behave like relays. It can able to switch ON and OFF. But this is for internal purpose. This will not exist in the real world.

22. List the different programming methods of PLC? [Nov/Dec 2018]

Ladder Logic: Ladder logic was based off the circuit diagrams used to run relay logic hardware.
Function Block Diagrams: Function block diagrams visualize signal and data flows in a block diagram and show the function between input and output variables.
Structured Text: Structured text is block structured with syntax based on the Pascal programming language. It is a high elvel text language that encourages structured programming.
Instruction Lists: This low level text language is similar to the assembly programming language. The variables and function calls are defined by common elements, much like in the structured text method outline above. Program control is acheived by jump instructions and function calls, which are like subroutines with optional parameters.
Sequential Function Charts: The sequential function chart coordinates large, complicated programming tasks into smaller, more manageable functions. It breaks a sequential task down into steps, transitions and actions.

23. What is meant by Data Movement?

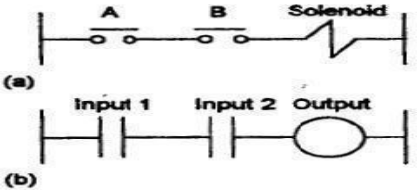
Data transfer is the method used by a PLC to move data from one point to another. This can include transferring data from one memory location to another memory location or groups of memory locations, or it can also include the procedure required to move data either to or from an analog I/O module.



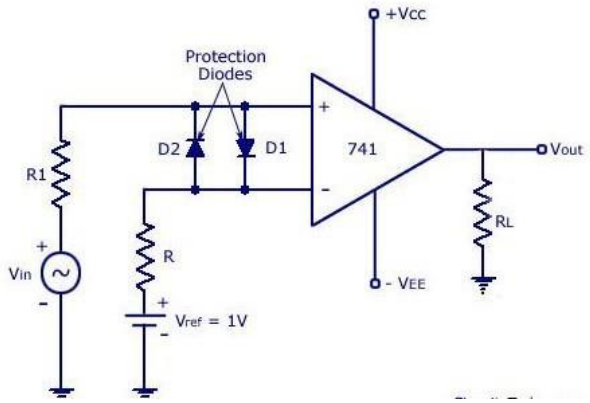
24. What is meant by down counter?

Down counter counts down from the preset value to zero. Events are subtracted from the preset value. When zero is reached the counters contact changes state.

25. Draw the sketch of AND gate using ladder diagram. [Apr/May 2013]



26. Draw the schematic of Comparator. **[Apr/May 2013]**



PART B

1. Define PLC. With the help of a block diagram, explain the main components of a PLC and list its Applications. **[Apr/May 2018]**

2. Sketch the basic architecture of a PLC and explain the function of each element.[**Nov/Dec 16/17]**

3. Write Short notes on (i) Data movement (ii) Data Comparison **[Nov/Dec 2016]**

4. Explain how a PLC can be used to handle an Analogue input with suitable example. Delay – Off Timer

5. Explain the following (i) Delay –Off Timer (ii) Delay – ON Timer (iii) Steady state error

6. Explain the principle and operation of self-tuning circuit with block diagram.

7. Discuss how AND, OR, NOR ,NAND,XOR and XNOR systems can be formed with ladder diagram **[April /May 2017/18][Nov/Dec 2018]**

8. (i) Write short notes on JUMP Control used in PLC **[April /May 2017]**
(ii) Brief on Timers and Counters

9. What is shift register? Explain the working of shift register using ladder diagram

10. Explain the Data Handling System in PLC using the ladder diagram in detail.**[Nov/Dec 2015]**

11. Explain the Master relay control in PLC with ladder diagram **[Nov/ Dec 2013]**

12. Explain the following (i) Timers (ii) Counters (iii) Internal Relays **[Nov/ Dec 2013/17]**

13. Explain the configuration of a PLC. List the consideration in selecting a PLC.**[Nov/ Dec17]**

14. Explain about mnemonics with examples. **[Nov/Dec 2015]**

15. Explain the construction and I/O details of PLC. **[Nov/ Dec 2018]**

PART-C

1. Device a circuit that could be used with a domestic washing machine to switch on a pump. To pump Water for 100s into the machine then switch OFF and switch ON a heater for 50s, to heat the water. The heater is then switched OFF, and another pump is to empty the water from the machine for 100s.
2. Create a ladder diagram for the following application: A pneumatic system with double solenoid valves controls two double acting cylinders A and B. The sequences of cylinder operations are as follows: Cylinder B retracts and finally the cycle is completed by the Cylinder A retracting. Explain the logic of the PLC circuit used.

3. What is meant by Counters? Name the various types of counters and draw a ladder diagram to control a machine which is required to direct 6 items along one path for packaging in a box and then 12 items along another path for packaging in anotherbox.

UNIT-V

ACTUATORS AND MECHATRONIC SYSTEM DESIGN

PART-A

1. List out the drawbacks of traditional design approach. [Nov/Dec 2012]

The drawbacks of traditional design approach are:

- Less flexible
- Less accurate
- More complicate mechanism in design
- It involves more components and moving parts

2. What is the role of an opto-isolator in robot control? [Nov/Dec 2012]

An opto-isolator, also called an opto coupler, photo coupler, or optical isolator, is a component that transfers electrical signals between two isolated circuits by using light. The main function of an opto- isolator is to block such high voltages and voltage transients, so that a surge in one part of the system will not disrupt or destroy the other parts.

3. What are the sensors used in a car engine management system? [Apr/May 2017/18]

Crankshaft sensor, Camshaft sensor, Wheel speed sensor, Knock Sensor, Pressure sensor - MAP and T- MAP sensors.

4. Automatic camera is a mechatronics system – Justify.

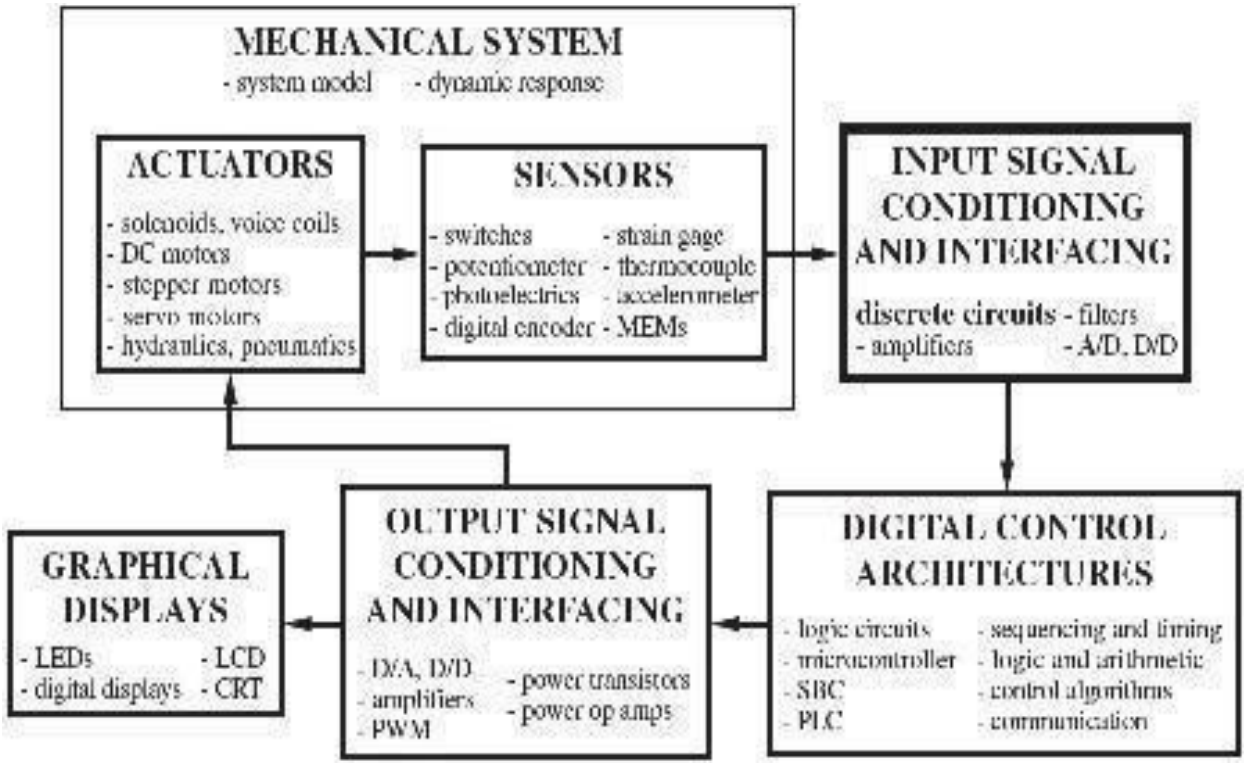
A typical mechatronics system should have some of the basic elements such as actuators, sensors, signal conditioning elements, digital logic systems, software, display devices, etc., As the automatic camera has all those elements, it is considered as mechatronics system.

5. What are the mechatronics elements used in an automatic camera?

The various mechatronics elements in an automatic camera are:

- Auto-focusing mechanism control
- Aperture drive
- Shutter drive
- Mirror drive
- Lens position encoder
- Lens drive
- Film advance mechanism control

6. Draw flow chart of Mechatronics system. [Nov/Dec 2013]



7. Compare traditional design with mechatronics design. [Apr/May 2018]

S.No	Traditional design	Mechatronics design
1.	It is based on traditional systems such as hydraulic, mechanical and pneumatic systems	It is based on mechanical, electronics, computer technology and control engineering
2.	Less flexible	More flexible
3.	Less accurate	More accurate
4.	More complicate mechanism in design	Less complicate mechanism in design
5.	It involves more components and moving parts	It involves fewer components and moving parts

8. What are the mechatronics elements used in an automatic camera?

The various mechatronics elements in an automatic camera are:

- Auto-focusing mechanism control
- Aperture drive
- Shutter drive
- Mirror drive
- Lens position encoder
- Lens drive
- Film advance mechanism control

9. What are the advantages of using a microprocessor in the place of a mechanical controller for a carburetor of an automobile?

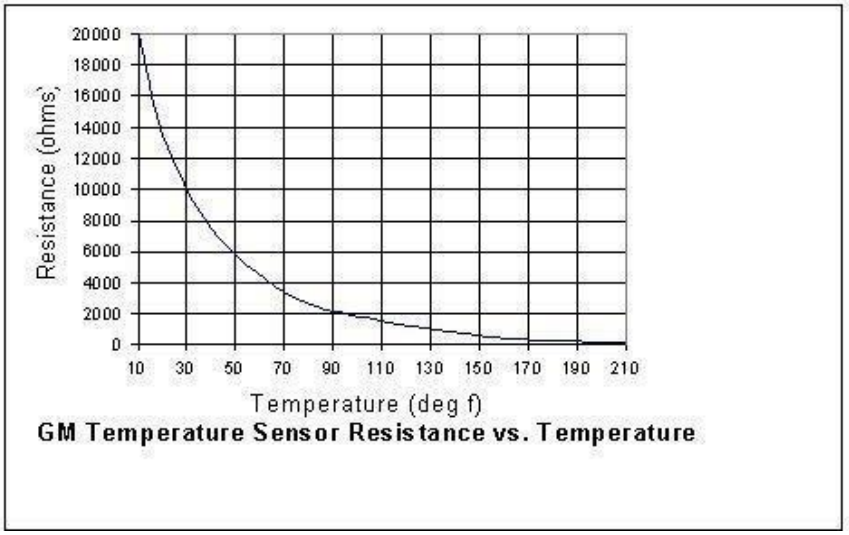
The advantages of using a microprocessor in the place of a mechanical controller for a carburetor of an automobile are:

- Microprocessor controller is more accurate in terms of supplying proper mixture air fuel ratio based on the variation of load.
- It also avoids detonation by getting feedback from the knock sensor placed in the engine block.
- It involves fewer components and moving parts and hence less wear and long life.

10. List out the seven modules of mechatronics design approach. [Nov/Dec 2011]

- Need for design
- Analysis of problem
- Preparation of specification
- Generation of possible solution
- Selection of suitable solution or evaluation
- Production of detailed design
- Production of working drawing
- Implementation of design

11. Draw the characteristics of engine temperature sensor. [Nov/Dec 2015]



12. What is meant by timed switch? [Nov/Dec 2009]

The device which is used to start the pulse applied, check the timer whether it is ON or OFF condition and timer should be in OFF condition before triggering is called timed switch.

13. Write the working principle of stepper motor.[Nov/Dec 2018]

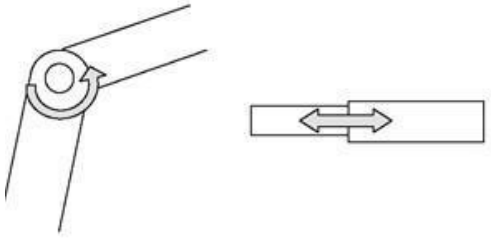
The stepper motor rotor is a permanent magnet, when the current flows through the stator winding, the stator winding to produce a vector magnetic field. The magnetic field drives the rotor to rotate by an angle so that the pair of magnetic fields of the rotor and the magnetic field direction of the stator are consistent. When the stator's vector magnetic field is rotated by an angle, the rotor also rotates with the magnetic field at an angle.

14. How is a traditional design of temperature control of domestic central heating system improved by mechatronics design?

The traditional design of the temperature control for a central AC system involves a bimetallic thermostat in a closed loop control system. The basic principle behind this system is that the bending of the bimetallic strip changes as the temperature change and is used to operate an ON/OFF switch for the temperature control of the AC system. The same system is modified by mechatronics approach. This system uses a microprocessor controlled thermocouple as the sensor. Such a system advantages over traditional system. The bimetallic thermostat is less sensitive compared to the thermo diode.

15. Differentiate between revolute and prismatic joint

Prismatic Joint - A **prismatic joint** provides a linear sliding movement between two bodies, and is often called a slider, as in the slider-crank linkage. A prismatic joint can be formed with a polygonal cross-section to resist rotation. See for example the dovetail joint and linear bearings.



A **revolute joint** (also called **pin joint** or **hinge joint**) is a one-degree-of- freedom kinematic pair used in mechanisms. Revolute joints provide single-axis rotation function used in many places such as door hinges, folding mechanisms, and other uni-axial rotation devices

16. What are the factors to be considered while selecting a motor? [Apr/May 2013]

The factors to be considered while selecting a motor are

- Speed of a motor
- Starting torque and rotational torque of a motor
- Size and style of a motor.

17. What are different types of stepper motors? [Nov/Dec2017]

Permanent magnet stepper motor

Variable reluctance stepper motor

Hybrid stepper motor

18. What is meant by servomotor? [Nov/Dec 2017]

A servomotor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback, through a reduction gearbox.

19. Mention the use of PLC in automatic car park system? [April/May 2017]

The automation process of an automatic car parking system is designed using fully functional ladder logic based LOGO!12/24 RC, which is a small programmable logic controller (PLC).After that it gives the input signals to PLC to count the number of vehicles entering and

leaving the parking respectively.

20. What are the applications of a servomotor in mechatronics systems? [Nov/Dec2010]

Servomotor are used in mechatronics systems for position control, velocity control and torque control in various applications such as CNC machine tools, robots.

21. What are the applications of stepper motor in mechatronics system [Apr/May 2010]

The applications of stepper motor in mechatronics system are

- High accuracy positioning applications in robotics
- Computer hard disc drives

22. List the sensors used in car parking barrier system and mention it's uses.[Nov/Dec 2016]

Sensors - Proximity Sensors, Electromagnetic or Ultrasonic Sensors

There are two barriers used, namely in barrier and out barrier. In Barrier is used to open when the correct money is inserted while out barrier open when the car is detected in front of it.

23. What could be a suitable actuator for robot arm joint? Justify.

The actuator of a robot arm may be servomotor or pneumatic rotary actuator and hydraulic rotary actuator. The selection of actuator depends on the purpose of use of the robot. However, most of the robots uses servomotor as an actuator because of precise and easy control mechanism.

23. Compare the AC and DC servomotor?

S.NO	DC Servomotor	AC Servomotor
1.	High power output.	Relatively lesser power output than a DC servomotor of same size.
2.	Suitable for large power application.	Suitable for low power application.
3.	Characteristics are linear	Characteristics are non-linear
4.	Fast response due to low electrical and mechanical time constant.	The response is relatively slower than DC servomotors due to high values of time constant.

24. What are the performance specifications of servo motor?

a. Shaft speed
b. Terminal voltage
c. Torque

25. What are the advantages of DC servomotor?

A simpler, more reliable motor because the fluid power supply is not applied.

High efficiency due to the absence of field losses.

Field flux is less affected by temperature rise.

Less heating, making it possible to totally enclose the motor.

PART – B

1. Explain the stages in designing Mechatronics systems in detail? **[May/June 2013]**

[April/May 2017/18][Nov/Dec 2017/18]

2. Device a robot system which can be used for pick and place purpose. Describe the various Mechatronics elements used in the design. **[Nov/Dec2013/16]**

3. Compare traditional design and Mechatronics design with suitable example. **[April/May 2017]**

4. Explain the working at anyone type of microprocessor based controller with neat diagram.

5. Discuss Mechatronics design of an automatic car park system.

[April/May 2015/17][Nov/Dec 2018]

6. Explain the working of a sequential control of ―washing machine system with a neat diagram.

[April/May 2015]

7. Device a car parking barrier system and write the appropriate PLC programming ladder diagram to execute the system. **[May/ June2013][Nov/Dec2017]**

8. Design a Mechatronics system for a automatic camera and explain the various Mechatronics elements.

9. Explain the various elements present in Engine management system with appropriate block diagram. **[Nov/Dec 2013, 2016][Apr/May 2018]**

10. Details about the various functional components in a wireless surveillance balloon system.

11. Design a mechatronics system for a ATM and explain the various Mechatronics elements.

12. What is Stepper motor? What are the types of stepper motor?

13. Explain the operation of permanent magnet stepper motor and variable reluctance stepper motor.

14. Explain the construction of AC servomotor and its operations.

15. Brief the operation and construction of DC servomotors. **[Nov/Dec 2015]**

16. Compare the DC and AC Servomotor.

PART-C

1. Explain the working of wind screen-wiper mechanism with a neat diagram also draw the interfacing circuit.
2. With a neat circuit, brief the control system and the communication system used in the wireless surveillance balloon.
3. Design a mechatronics system for a Automatic Tool Changer of CNC machine and explain the various mechatronics elements.