JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OF

MECHANICAL ENGINEERING

QUESTION BANK

VI SEMESTER

ME6702 – Mechatronics

Regulation – 2013

JEPPIAAR ENGINEERING COLLEGE

Vision of Institution

To build Jeppiaar Engineering College as an institution of academic excellence in technological and management education to become a world class university.

Mission of Institution

- To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking.
- To participate in the production, development and dissemination of knowledge and interact with national and international communities.
- To equip students with values, ethics and life skills needed to enrich their lives and enable them to meaningfully contribute to the progress of society.
- To prepare students for higher studies and lifelong learning, enrich them with the practical and entrepreneurial skills necessary to excel as future professionals and contribute to Nation's economy.

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department

To create excellent professionals in the field of Mechanical Engineering and to uplift the quality of technical education on par with the International Standards.

Department Mission

1. **To reinforce** the fundamentals of Science and Mathematics to Mechanical Engineering **and critically and relatively investigate co**mplex mechanical systems and processes.
2. To engage in the **production, expansion and practice** of advanced engineering applications through knowledge sharing activities by interacting with global communities and industries.
3. To**equip** students with **engineering ethics, professional roles, corporate social responsibility** and life skills and **apply** them for the betterment of society.
4. **To promote** higher studies and lifelong learning and entrepreneurial skills and **develop** excellent professionals for empowering nation's economy.

PEO's

1. To **enrich** the technical knowledge of design, manufacturing and management of mechanical systems and **develop creative and analytical thinking** in research.
2. To **relate, strengthen and develop** the theoretical knowledge of the Mechanical Engineering by exhibiting various concepts applied through diverse industrial exposures and experts' guidance.
3. **Facilitate** the students to communicate effectively on complex social, professional and engineering activities with strict adherence to ethical principles.
4. **Create awareness for independent and life long learning and develop the ability to keep abreast of modern trends and adopt them for personal technological growth of the nation.**

PSO's

1. To understand the basic concept of various mechanical engineering field such as design, manufacturing, thermal and industrial engineering.
2. To apply the knowledge in advanced mechanical system and processes by using design and analysis techniques.
3. To develop student's professional skills to meet the industry requirements and entrepreneurial skills for improving nation's economy stronger.

ME6702- MECHATRONICS

COURSE OUTCOMES

C402.1	The student will have fundamental knowledge in the field of mechatronics.
C402.2	The student can able to understand on architecture of various processors and controllers in the areas of mechatronic engineering.
C402.3	The student will have knowledge to integrate and use systems or devices incorporating modern microelectronics and information technologies
C402.4	The student will gain the knowledge to dealing with the operations by using PLC programming.
C402.5	The student can develop knowledge of various motor systems and practical application in their profession.

ME6702 **MECHATRONICS** **L T P C**
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OBJECTIVES:

- ToimpartknowledgeabouttheelementsandtechniquesinvolvedinMechatronicssystems whichareverymuchessential tounderstandtheemerging fieldofautomation.

UNITI INTRODUCTION **12**

Introduction to Mechatronics– Systems– Concepts ofMechatronics approach– Need for Mechatronics– EmergingareasofMechatronics–ClassificationofMechatronics.Sensors and Transducers**:**Staticand dynamicCharacteristicsofSensor,Potentiometers–LVDT–Capacitance sensors–Straingauges– Eddycurrentsensor –Halleffectsensor–Temperaturesensors–Light sensors

UNITII 8085MICROPROCESSORAND 8051MICROCONTROLLER **10**

Introduction–Architectureof8085–PinConfiguration–AddressingModes–Instructionset, Timing diagramof8085– Conceptsof8051microcontroller–Blockdiagram,.

UNITIII PROGRAMMABLEPERIPHERAL INTERFACE **8**

Introduction–Architectureof8255,Keyboardinterfacing,LEDdisplay–interfacing,ADCandDAC interface, TemperatureControl–StepperMotorControl–Traffic Controlinterface.

UNITIV PROGRAMMABLELOGICCONTROLLER **7**

Introduction–Basicstructure– Inputandoutputprocessing–Programming–Mnemonics– Timers, countersandinternalrelays–Datahandling–SelectionofPLC.

UNITV ACTUATORSAND MECHATRONIC SYSTEMDESIGN **8**

TypesofStepperandServomotors–Construction– WorkingPrinciple–Advantagesand Disadvantages.Design process-stages ofdesignprocess– TraditionalandMechatronicsdesign concepts–Case studies ofMechatronics systems–Pickand place Robot–Engine Management system– Automaticcarparkbarrier.

TOTAL:45PERIODS

OUTCOMES:

- Uponcompletionofthiscourse,thestudentscanabletodesignmechatronicssystemwiththe helpofMicroprocessor,PLC andotherelectricalandElectronics Circuits.

TEXT BOOKS:

1. Bolton, “Mechatronics”,PrinticeHall,2008
2. RameshSGaonkar,“MicroprocessorArchitecture,Programming,andApplicationswiththe8085” , 5thEdition,PrenticeHall,2008.

REFERENCES:

1. MichaelB.HistandandDavisG.Alciatore,“IntroductiontoMechatronicsandMeasurement systems”,McGrawHill International edition,2007.
2. Bradley D.A,DawsonD,BuruN.CandLoaderA.J, “Mechatronics”,Chapmanand Hall,1993.
3. Smaili.AandMrad.F,“MechatronicsIntegratedTechnologies forIntelligentMachines”,Oxford UniversityPress,2007.
4. DevadasShettyand Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company,2007.
5. KrishnaKant, “Microprocessors&Microcontrollers”, PrenticeHall ofIndia, 2007.
6. ClarenceW, deSilva,"Mechatronics"CRC Press, First Indian Re-print, 2013

JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OFMECHANICAL ENGINEERING

QUESTION BANK

Subject : ME6702 – MECHATRONICS

Year / Sem : IV / VII

UNIT I- INTRODUCTION

Introduction to Mechatronics– Systems– Concepts ofMechatronics approach– Need for Mechatronics– EmergingareasofMechatronics–ClassificationofMechatronics.Sensors and Transducers:Staticand dynamicCharacteristicsofSensor,Potentiometers–LVDT–Capacitance sensors–Straingauges–Eddycurrentsensor –Halleffectsensor–Temperaturesensors–Light sensors

PART-A

CO Mapping : C311.1

Q. No.	Questions	BT Level	Competence	PO
1	Define Mechatronics.	**BTL-1**	Remembering	**PO1, PO12**
2	What is a system? Give an example.	**BTL-1**	Remembering	**PO1, PO12**
3	What is a measurement system?	**BTL-1**	Remembering	**PO1, PO12**
4	Write about the sensor and give an example.	**BTL-1**	Remembering	**PO1, PO12**
5	Write about the signal conditioner.	**BTL-1**	Remembering	**PO1, PO12**
6	What are the two basic forms of the control system?	**BTL-1**	Remembering	**PO1, PO12**
7	What are the elements of the closed loop control system?	**BTL-1**	Remembering	**PO1, PO12**
8	What are the two types of feedback loop?	**BTL-1**	Remembering	**PO1, PO12**
9	What are the types of control elements?	**BTL-1**	Remembering	**PO1, PO12**
10	What are the various elements of a closed loop system for a person controlling the temperature?	**BTL-1**	Remembering	**PO1, PO12**
11	Write about the Mechatronics approach in a micro processor – controlled washing machine.	**BTL-1**	Remembering	**PO1, PO12**
12	What is the larger scale application of Mechatronics?	**BTL-1**	Remembering	**PO1, PO12**
13	List some of the applications of Mechatronics.	**BTL-1**	Remembering	**PO1, PO12**
14	What are the components of Mechatronics Systems?	**BTL-1**	Remembering	**PO1, PO12**
15	What is meant by a system in Mechatronics?	**BTL-1**	Remembering	**PO1, PO12**
16	What are the main applications of Mechatronics?	**BTL-1**	Remembering	**PO1, PO12**
17	Draw the block diagram of measurement system.	**BTL-1**	Remembering	**PO1, PO12**
18	Sketch the graphical representation of Mechatronics	**BTL-1**	Remembering	**PO1, PO12**

	system.			
Q. No.	**Questions**	**BT Level**	**Competence**	**PO**
19	Obtain the basic functions of control systems.	**BTL-1**	Remembering	**PO1, PO12**
20	What are the types of control system?	**BTL-1**	Remembering	**PO1, PO12**
21	List down the requirements of control systems.	**BTL-1**	Remembering	**PO1, PO12**
22	Give an example for open loop system and closed loop systems.	**BTL-1**	Remembering	**PO1, PO12**
23	Compare open loop control system and closed loop control system.	**BTL-1**	Understanding	**PO1, PO12**
24	What are the basic elements of feedback system?	**BTL-1**	Remembering	**PO1, PO12**
25	What is meant by sequential control , what are the two modes in it?	**BTL-1**	Remembering	**PO1, PO12**
26	Give an example for event-based and time-based sequential control.	**BTL-1**	Remembering	**PO1, PO12**
	PART-B&PART-C			
1	Explain the two types of temperature measurement sensor	**BTL-2**	Understanding	**PO1, PO12**
2	Write a detailed note on pressure measuring system and pressure measuring transducer.	**BTL-1**	**Understanding**	**PO1, PO12**
3	i) Explain the working of Pneumatic load cell. (ii)Explain the temperature measurement using thermocouples.	**BTL-2** **BTL-2**	Understanding Understanding	**PO1, PO12**
4	i) How bourdon tube is used to measure the pressure? ii) How is bernoulli's principle used to measure the flow rate?	**BTL-** **1BTL-1**	Remembering Remembering	**PO1, PO12**
5	i) Discuss how displacement is sense by LVDT, with a neat sketch show how it can be made phase sensitive. ii) What are the applications of bimetallic strip? Discuss their types and principle of operation respectively.	**BTL-6** **BTL-4**	Creating Applying	**PO1, PO12**
6	i) List and define the dynamic characteristics of sensors. ii) With an example explain the various functional units of a measurement system. Suggest a sensor whose output is an electrical signal for the following and explain them in detail.	**BTL-1** **BTL-2**	Understanding Remembering	**PO1, PO12**

UNIT II 8085 MICROPROCESSOR AND MICROCONTROLLER

Introduction–Architectureof8085–PinConfiguration–AddressingModes–Instructionset, Timing diagramof808 Conceptsof8051microcontroller–Blockdiagram,.

PART-A

CO Mapping : C311.2

Q.No.	Questions	BT Level	Competence	PO
1	What is the purpose of a sensor?	**BTL-1**	Remembering	**PO1, PO12**
2	Define transducer.	**BTL-1**	Remembering	**PO1, PO12**
3	What are the terms that define the performance of the transducers?	**BTL-1**	Remembering	**PO1, PO12**
4	Define static characteristics.	**BTL-1**	Remembering	**PO1, PO12**
5	Define dynamic characteristics.	**BTL-1**	Remembering	**PO1, PO12**
6	What are the terms that you can find from the dynamic characteristics?	**BTL-1**	Remembering	**PO1, PO12**
7	What is a displacement sensor?	**BTL-1**	Remembering	**PO1, PO12**
8	What is a position sensor?	**BTL-1**	Remembering	**PO1, PO12**
9	What is a proximity sensor?	**BTL-1**	Remembering	**PO1, PO12**
10	What is the two basic types of the displacement and the position transducers?	**BTL-1**	Remembering	**PO1, PO12**
11	Write about the strain – gaused element?	**BTL-1**	Remembering	**PO1, PO12**
12	Define gauge factor.	**BTL-1**	Remembering	**PO1, PO12**
13	Write about the gauge factors for different types of strain gauges.	**BTL-1**	Remembering	**PO1, PO12**
14	What is the capacitance of a parallel plate capacitor?	**BTL-1**	Remembering	**PO1, PO12**
15	Define LVDT.	**BTL-1**	Remembering	**PO1, PO12**
16	Determine the working principle of LVDT.	**BTL-5**	Evaluating	**PO1, PO12**
17	What are the uses of LVDT?	**BTL-1**	Remembering	**PO1, PO12**
18	Write about inductive proximity switch.	**BTL-1**	Remembering	**PO1, PO12**
19	What is an encoder?	**BTL-1**	Remembering	**PO1, PO12**
20	What are the two types of position encoders ?	**BTL-1**	Remembering	**PO1, PO12**
21	What is an incremental encoder?	**BTL-1**	Remembering	**PO1, PO12**
22	Write about absolute encoder.	**BTL-1**	Remembering	**PO1, PO12**
23	What are the uses of photosensitive devices?	**BTL-1**	Remembering	**PO1, PO12**
24	Write about Hall effect sensors.	**BTL-1**	Remembering	**PO1, PO12**
25	What is Hall coefficient?	**BTL-1**	Remembering	**PO1, PO12**
26	What are digital signals?	**BTL-1**	Remembering	**PO1, PO12**
27	Why the signal conditioning is required?	**BTL-4**	Analyzing	**PO1, PO12**

Q.No.	Questions	BT Level	Competence	PO
	PART-B&PART-C			
1	Explain two types gear drives in mechatronics system.	**BTL-2**	Understanding	**PO1, PO12**
2	Explain construction and working principle of AC and DC motor.	**BTL-2**	Understanding	**PO1, PO12**
3	i) What is the principle and construction of vane pump and vane motor? ii) Describe the basic details of basic details of a 4/2 valve and 5/2 valve.	**BTL-1** **BTL-1**	Remembering Remembering	**PO1, PO12**
4	Explain the construction and working principle of AC and DC motor.	**BTL-2**	Understanding	**PO1, PO12**
5	i)List the various types of bearing. Also mention their capabilities and applications. ii) Describe the working of an AC servo motor.	**BTL-1BTL-2**	Remembering Understanding	**PO1, PO12**
6	i) Explain different types of cam and followers. ii) A toothed gear has 72 teeth and circular pitch of 26mm, find pitch diameter, diametral pitch and module of the gear.	**BTL-2** **BTL-1**	Understanding Remembering	**PO1, PO12**
7	With the help of proper control circuits explain the speed control of AC and DC motors.	**BTL-2**	Understanding	**PO1, PO12**
8	i) Using simple circuit explain the basic components required for a hydraulic actuation system. ii) List the types of bearings and brief about each.	**BTL-2** **BTL-1**	Understanding Remembering	**PO1, PO12**
	UNITIII PROGRAMMABLEPERIPHERAL INTERFACE			
Introduction–Architectureof8255,Keyboardinterfacing,LEDdisplay–interfacing,ADCandDAC interface, TemperatureControl–StepperMotorControl–Traffic Controlinterface.				
	PART-A			
CO Mapping : C311.3				
Q.No.	**Questions**	**BT Level**	**Competence**	**PO**
1	Define Actuator.	**BTL-1**	Remembering	**PO1, PO12**
2	Classify actuator based on motion.	**BTL-4**	Analyzing	**PO1, PO12**

3	When is cascade control needed?	**BTL-1**	Remembering	**PO1, PO12**
Q.No.	**Questions**	**BT Level**	**Competence**	**PO**
4	Write down principles of cascade control.	**BTL-1**	Remembering	**PO1, PO12**
5	Mention the various components of a hydraulic system.	**BTL-1**	Remembering	**PO1, PO12**
6	What is called pneumatic system?	**BTL-1**	Remembering	**PO1, PO12**
7	List down the components of pneumatic system.	**BTL-1**	Remembering	**PO1, PO12**
8	What is the purpose of using filters in the hydraulic systems?	**BTL-1**	Remembering	**PO1, PO12**
9	What are the types of pumps used as energy source in a hydraulic system?	**BTL-1**	Remembering	**PO1, PO12**
10	What are the factors to be considered for selecting compressors?	**BTL-1**	Remembering	**PO1, PO12**
11	What are the uses of air receiver?	**BTL-1**	Remembering	**PO1, PO12**
12	State the purpose of providing air dryers.	**BTL-1**	Remembering	**PO1, PO12**
13	State the function of a control value.	**BTL-1**	Remembering	**PO1, PO12**
14	List the different control values.	**BTL-1**	Remembering	**PO1, PO12**
15	Define the term degress of freedom.	**BTL-1**	Remembering	**PO1, PO12**
16	Define kinematic pair.	**BTL-1**	Remembering	**PO1, PO12**
17	When is cascade control needed?	**BTL-1**	Remembering	**PO1, PO12**
18	List the features of synchronous motor.	**BTL-1**	Remembering	**PO1, PO12**
19	What is stepper motor?	**BTL-1**	Remembering	**PO1, PO12**
20	What is servomotor?	**BTL-1**	Remembering	**PO1, PO12**
21	What is synchro?	**BTL-1**	Remembering	**PO1, PO12**
22	At what conditions SPDT, DPST and DPDT switches are used?	**BTL-1**	Remembering	**PO1, PO12**
23	What are the factors to be considered for selecting solenoids?	**BTL-1**	Remembering	**PO1, PO12**
24	What is the principle of relay?	**BTL-1**	Remembering	**PO1, PO12**
25	What is zener voltage?	**BTL-1**	Remembering	**PO1, PO12**
26	Name three output characteristics of transistor configuration.	**BTL-2**	Understanding	**PO1, PO12**
PART-B & PART-C				
Q.No.	**Questions**	**BT Level**	**Competence**	**PO**
1	Discuss Briefly model building block for automatic suspension system and electrical motor.	**BTL-6**	Creating	**PO1, PO12**

2	Discuss briefly the following control modes. a) PI controller b) PID controller	**BTL-6**	Creating	**PO1, PO12**
3	i) Briefly explain ON OFF controllers and give their limitations. ii) Describe and applications of proportional controllers and their limitations.	**BTL-2** **BTL-4**	Understanding Analyzing	**PO1, PO12**
4	i) Explain the system modeling of a chamber filled with fluid. ii) Explain the various types of control modes.	**BTL-2** **BTL-2**	UnderstandingUnderstanding	**PO1, PO12**
5	i) Explain briefly a mathematical model of a vehicle moving on a road. ii) Explain in detail about digital controllers.	**BTL-2** **BTL-2**	Understanding Understanding	**PO1, PO12**
6	Explain the model building using the basic building blocks for a i)Automobile suspension system ii) Electrical motor.	**BTL-2**	Understanding	**PO1, PO12**
7	Discuss in detail about PI and PD mode electronic controllers.	**BTL-6**	Creating	**PO1, PO12**

UNITIV PROGRAMMABLELOGICCONTROLLER				
Introduction–Basicstructure– Inputandoutputprocessing–Programming–Mnemonics– Timers, countersandinternalrelays–Datahandling–SelectionofPLC.				
PART A				
CO Mapping : C311.4				
Q.No.	**Questions**	**BT Level**	**Competence**	**PO**
1	What is a microprocessor?	**BTL-1**	Remembering	**PO1, PO12**
2	What are the four components of a programmable machine?	**BTL-1**	Remembering	**PO1, PO12**
3	Define the terms: a)Bus b)RAM c)ROM	**BTL-1**	Remembering	**PO1, PO12**
4	What are the types of language used?	**BTL-1**	**Remembering**	**PO1, PO12**
5	What is a machine language?	**BTL-1**	Remembering	**PO1, PO12**
6	What is an assembly language?	**BTL-1**	Remembering	**PO1, PO12**
7	What is low-level language?	**BTL-1**	Remembering	**PO1, PO12**
8	What is high-level language?	**BTL-1**	Remembering	**PO1, PO12**
9	Differentiate a compiler and an interpreter?	**BTL-1**	Understanding	**PO1, PO12**
10	What are the two parts of an instruction?	**BTL-1**	Remembering	**PO1, PO12**
11	What are the types of bus?	**BTL-1**	Remembering	**PO1, PO12**
12	Define the term : Data Bus,Address bus, Control bus.	**BTL-1**	Remembering	**PO1, PO12**
13	Write about the 16-bit register of a 8085 microprocessor.	**BTL-1**	Remembering	**PO1, PO12**
14	What are the twotypes of memories?	**BTL-1**	Remembering	**PO1, PO12**

15	Write about the SRAM.	**BTL-1**	Remembering	**PO1, PO12**
16	What are the advantage of DRAM?	**BTL-1**	Remembering	**PO1, PO12**
17	What are the disadvantages of DRAM?	**BTL-1**	Remembering	**PO1, PO12**
Q.No.	**Questions**	**BT Level**	**Competence**	**PO**
18	What is flash memory?	**BTL-2**	Understanding	**PO1, PO12**
19	What are the interfacing devices?	**BTL-1**	Remembering	**PO1, PO12**
20	Write about buffer.	**BTL-1**	Remembering	**PO1, PO12**
21	Define looping.	**BTL-1**	Remembering	**PO1, PO12**
22	What are the types of loops?	**BTL-1**	Remembering	**PO1, PO12**
23	Write about continuous loop.	**BTL-1**	Remembering	**PO1, PO12**
24	What are the instructions of a 8085 instruction set for data transfer from memory to the microprocessor?	**BTL-1**	Remembering	**PO1, PO12**
25	Write about conditional loop.	**BTL-1**	Remembering	**PO1, PO12**
26	What are the instructions of a 8085 instruction set for data transfer from microprocessor to the memory?	**BTL-1**	Remembering	**PO1, PO12**
27	What are the opcodes related to rotating the accumulator bits?	**BTL-1**	Remembering	**PO1, PO12**
28	What is dynamic debugging?	**BTL-1**	Remembering	**PO1, PO12**
29	What are the tools used for dynamic debugging?	**BTL-1**	Remembering	**PO1, PO12**
30	Write about single step.	**BTL-1**	Remembering	**PO1, PO12**
PART-B& PART-C				
1	i) Explain the configuration of PLC. ii) Give advantages of PLC system over traditional mechanical system.	**BTL-2**	Understanding	**PO1, PO12**
2	Explain the following a) Registers b) Counters c) Internal Relays d) Timers	**BTL-2**	Understanding	**PO1, PO12**
3	Explain the basic structure of PLC.	**BTL-2**	Understanding	**PO1, PO12**
4	Explain the following a) Registers b) Counters c) Internal Relays	**BTL-2**	Understanding	**PO1, PO12**
5	Device a PLC circuit for the following application: Consider a conveyor belt that is to be used to transport goods from a loading machine to a packaging area. When item is loaded into the conveyor belt, a contact switch might be used to indicate that the item is on the belt and start the conveyor motor. The motor then has to keep running until the item reaches the far end of the conveyor and falls off into the packaging area. When it does this, a switch might be activating which has the effect	**BTL-3**	**Applying**	**PO1, PO12**

	of switching of the conveyor motor. The motor is then to remain off until the next item is loaded onto the belt.			
6	Device PLC circuit for the following application : Consider a simple goods lift to move items from one level to another. The lift is to move upwards when a push button is pressed at the ground level to send the lift upwards or a push button is pressed at the upper level to request the lift to move upwards but in both cases there is a condition that has to be met that a limit switch indicates that the access gate to the lift platform is closed.	**BTL-3**	Applying	**PO1, PO12**

UNIT V ACTUATORSAND MECHATRONIC SYSTEMDESIGN

TypesofStepperandServomotors–Construction– WorkingPrinciple–Advantagesand Disadvantages.Design process-stages ofdesignprocess– TraditionalandMechatronicsdesign concepts–Case studies ofMechatronics systems–Pickand place Robot–Engine Management system–Automaticcarparkbarrier.

PART-A

CO Mapping : C311.5

Q.No.	Questions	BT Level	Competence	PO
1	Write about the input /output channels.	**BTL-1**	Remembering	**PO1, PO12**
2	Write about the relay.	**BTL-2**	Understanding	**PO1, PO12**
3	What are opto isolators?	**BTL-4**	Analyzing	**PO1, PO12**
4	What are methods used for input/output processing?	**BTL-1**	Remembering	**PO1, PO12**
5	What is continuous updating?	**BTL-1**	Remembering	**PO1, PO12**
6	What is the disadvantages of continuous updating?	**BTL-1**	Remembering	**PO1, PO12**
7	Write about the mass input/output copying.	**BTL-2**	Understanding	**PO1, PO12**
8	What is a LATCH circuit?	**BTL-1**	Remembering	**PO1, PO12**
9	Define the term point and delay-on.	**BTL-1**	Remembering	**PO1, PO12**
10	Write about timer circuit.	**BTL-1**	Remembering	**PO1, PO12**
11	Write about internal relays.	**BTL-1**	Remembering	**PO1, PO12**
12	Write about counters.	**BTL-1**	Remembering	**PO1, PO12**
13	What is an up counter?	**BTL-1**	Remembering	**PO1, PO12**
14	What is an down counter?	**BTL-1**	Remembering	**PO1, PO12**
15	Write about shift register.	**BTL-1**	Remembering	**PO1, PO12**
16	What are the inputs of shift register?	**BTL-1**	Remembering	**PO1, PO12**
17	What the operations that are carried out with a PLC on data words?	**BTL-1**	Remembering	**PO1, PO12**
18	What is the criteria need for the selection of a PLC?	**BTL-1**	Remembering	**PO1, PO12**
19	What are the numbers of stages in the design process?	**BTL-1**	Remembering	**PO1, PO12**
20	What are the advantages of the microprocessor controlled system?	**BTL-1**	Remembering	**PO1, PO12**
21	What is the advantage of using PLC solution over mechanical solution?	**BTL-1**	Remembering	**PO1, PO12**
22	What are the axes of a pick and place robot?	**BTL-1**	Remembering	**PO1, PO12**
23	How do the movements of robot take place?	**BTL-1**	Remembering	**PO1, PO12**
24	What is the use of PLC in automatic car park system?	**BTL-1**	Remembering	**PO1, PO12**

25	How does a car park barrier works?	**BTL-1**	Remembering	**PO1, PO12**
26	Write about the engine speed sensor.	**BTL-1**	Remembering	**PO1, PO12**
27	How is the voltage produced by the oxygen sensor?	**BTL-1**	Remembering	**PO1, PO12**
28	Give some applications of microprocessor.	**BTL-1**	Remembering	**PO1, PO12**
PART-B& PART-C				
1	Explain about the mechanical system design of an automatic car park barrier.	**BTL-2**	Understanding	**PO1, PO12**
2	Explain about the various functional components in wireless surveillance balloon system.	**BTL-2**	Understanding	**PO1, PO12**
3	Discuss the mechatronic design of the pick and place robot with a neat control circuit.	**BTL-4** **BTL-2**	Remembering Understanding	**PO1, PO12**
4	Explain the design of a mechatronic system used in a engine management system	**BTL-6**	**Creating**	**PO1, PO12**
5	Explain with a neat circuit, the control system and the communication system used in the wireless surveillance balloon.	**BTL-6**	Creating	**PO1, PO12**
6	Detail about the various functional components in a wireless surveillance balloon system.	**BTL-2**	Understanding	**PO1, PO12**
7	Discuss mechatronic design of an automatic car parking system.	**BTL-6**	Creating	**PO1, PO12**
8	Discuss the mechatronic design of the pick and place robot with a neat control circuit.	**BTL-6**	Creating	**PO1, PO12**

UNIT I INTRODUCTION

Introduction to Mechatronics– Systems– Concepts ofMechatronics approach– Need for Mechatronics– EmergingareasofMechatronics–ClassificationofMechatronics.Sensors and Transducers:Staticand dynamicCharacteristicsofSensor,Potentiometers–LVDT–Capacitance sensors–Straingauges– Eddycurrentsensor –Halleffectsensor–Temperaturesensors–Light sensors.

PART-A

1. Define Mechatronics.

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

2. What is a system? Give an example.

A system can be considered as a box, which has an input, and an output and where it is not concerned with what goes on inside the box but only the relationship between the output and the input. Example: A motor may be thought of as a system, which has as its input electric power and as output the rotation of a shaft.

3. What is a measurement system?

A measurement system can be considered as a black box, which is used for making measurements. It has as its input the quantity being measured and its output the value of that quantity. Design skill – Ability to solve problems which will benefit the company.

4. Write about the sensor and give an example.

A sensor, which responds to the quantity being measured by giving as its output a signal which is related to the quantity. Example: A thermocouple is a temperature sensor. The input to the sensor is a temperature and the output is an e.m.f. which is related to the temperature value.

5. Write about the signal conditioner?

A signal conditioner takes the signal from the sensor and manipulates it in to a condition, which is suitable for either display, or in the case of a control system, for use to exercise control.

6. What are the two basic forms of the control system?

The two basic forms of the control systems are,

a. Open loop control system.

b. Closed loop control system.

Type Advantage Disadvantage

Open Loop a. It is being relatively simple

i.Low cost

ii. Good reliability

iii.inaccurate since there is no

iv.correction of error

Closed Loop Accurate in matching the actual

to the required values.

a. More complex

b. More costly

c. Greater chance of breakdown as a

consequence of the greater number

of components..

7. What are the elements of the closed loop control system?

The various elements of a closed loop control system are,

a. Comparison element

b. Control element

c. Correction element

d. Process element

e. Measurement element

8. What are the two types of feedback loop?

The two types of feed back loop are,

a. Positive feed back loop

b. Negative feed back loop.

"The feedback is said to be negative/positive feedback when the signal;

which is feed back, 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"

9. What are the types of control elements?

There are two types of control elements. They are

a. Hard – wired systems

b. Programmable systems.

10. 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,

1. Controlled variable
2. Comparison element
3. Error signal
4. Control unit
5. Measuring device

For example,

Controlled variable - The room temperature Reference value (The required room temperature)
Comparison element - The person comparing the measured value 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

11. Write about the Mechatronics approach in a micro-processor – controlled washing machine?

In the microprocessor-controlled washing machine, a mechanical system has become integrated with electronic controls. As a consequence, a bulky mechanical system is replaced by a much more compact microprocessor system, which is readily adjustable to give a greater variety of programs.

12. What is the larger scale application of Mechatronics?

A larger scale application of Mechatronics is a Flexible Manufacturing engineering System (FMS) involving computer – controlled machines, robots, automatic material conveying and overall supervisory control.

13. List some of the applications of Mechatronics?

1. Home Appliances: Washing machine, Bread machines etc
2. Automobile: Electrical fuel injection, Antilock brake system
3. Aircraft: Flight control, Navigation system
4. Automated Manufacturing

14. What are the components of Mechatronics System?

1. Actuators
2. Sensors
3. Signal Conditioning units
4. Digital control devices
5. Graphical Displays

15. What is meant by a system in Mechatronics?

The System is the group of physical component combined to perform a specific function. Any mechatronics devices consists of systems

16. What are the main applications of mechatronics?

Washing machines, dish washers, micro ovens, cameras, camcorders, robots, automatic conveyors, computer-controlled machines

17. Draw the block diagram of measurement system.

Quantity value
measured
Transducer or
Sensor
Signal
Processor Recorder
□

18. Sketch the graphical representation of mechatronics system.

Mechanical System
Graphical Displays

- LEDs
- LCD
- Digital Display
- CRT

Output Signal Conditioning and interfacing

- D/A,D/D
- Amplifier

Power Transistor

19. Obtain the basic functions of control systems.

1. To minimize the error between the actual and desired output
2. To minimize the time response to load changes in the system

20. What are the types of control system?

- Open loop system
- Closed loop system

21. List down the requirements of control systems.

- Stability
- Accuracy
- Response

22. Give an example for open loop system and closed loop systems.

1. Closed loop system – Automatic water level controller
2. open loop system - Electric fire

23. Compare open loop control system and closed loop control system.

Open loop systems	Closed loop systems
It is suitable where accurate positioning of the tools is not required	The feedback signal controls the table position accurately
System is very simple	Is used almost in all automation process
It is suitable for rough works	Its not suitable for rough works
Error is not currently checked and rectified	Error is currently checked and rectified

24. What are the basic elements of feedback system?

- Forward path
- Feedback path
- Error detecting device
- Amplifier
- Compensating network

25. What is meant by sequential control what are the two modes in it?

A system operating with sequential control is one where a set of prescribed operations are performed in sequence. The modes are, Event – based mode, Time – based mode

25. Give an example for event-based and time–based sequential control.

Time-based Water Heater

Event-based Domestic washing machine

PART-B

1.Write a detailed note on pressure measuring system and pressure measuring transducer.

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No: 9*

2. Discuss about the overall development of management thought. Explain the important contributions of Henry Fayol and Taylor in the field of management thoughts. (NOV 2017, MAY 2016, MAY 2015, MAY 2014, MAY 2013, MAY 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 28 to 38.*

3. Explain briefly about the different factors affecting the organizational environment. (MAY 2015)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 46 to 51.*

4. What is organizational culture? Explain the types of organizational culture. Explain the issues of organizational culture in modern organizations. (MAY 2017, MAY 2011)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 51to 60.*

5. Explain the types of Business organization. (Or Elucidate any four types of organization). (MAY 2017, MAY 2015, MAY 2014)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 547 to 549.*

6. Explain the trends and challenges of management in global scenario. Brief about the functions of MNC. (NOV 2017, MAY 2013, MAY 2012, NOV 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 98 to116.*

UNIT II 8085 MICROPROCESSOR AND MICROCONTROLLER

Introduction–Architectureof8085–PinConfiguration–AddressingModes–Instructionset, Timing diagramof8085–Conceptsof8051microcontroller–Blockdiagram.

PART-A

1. What is the purpose of a sensor?

Sensor is used for an element which produces a signal relating to the quantity being measured. I.e., an lectrical resistance temperature element, the quantity being measured is temperature and the sensor transforms an input of temperature into a change in resistance.

2. Define transducer?

The term transducer is often used in place of the term sensor. Transducer is defined as elements that when subject to some physical change experience a related change. Thus, sensors are transducers.

3. What are the terms that define the performance of the transducers?

1. Range and span
2. Error
3. Accuracy
4. Sensitivity
5. Hysteresis error
6. Non – linearity error
7. Repeatability / reproducibility
8. Stability

9. Dead band / time
10. Resolution
11. Output impedance.

4. Define static characteristics?

The static characteristics are the values given when the steady – state conditions occur. i.e., the values given when the transducer has settled down after having received some input.

5. Define dynamic characteristics?

The dynamic characteristics refer to the behavior between the time that the input value changes and the times that the value given by the transducer settles down to the steady – state value. Dynamic characteristics are stated in terms of the response of the transducer to inputs in particular forms.

6. What are the terms that you can find from the dynamic characteristics?

1. Response time.
2. Time constant.
3. Rise time
4. Settling time.

7. What is a displacement sensor?

Displacement sensors are concerned with the measurement of the amount by which some object has been moved.

8. What is a position sensor?

Position sensors are concerned with the determination of the position of some object with reference to some reference point.

9. What is a proximity sensor?

Proximity sensors are a form of position sensor and are used to determine when an object has moved to within some particular critical distance of the sensor.

10. What are the two basic types of the displacement and the position transducers?

The two basic types are,
1. Contact sensors
2. Non contact sensors.

11. Write about the strain – gauged element?

The electrical resistance strain gauge is a metal wire, metal foil strip, or a strip of semiconductor material, which is wafer – like and can be stuck onto surfaces like a postage stamp.

12. Define gauge factor.

The gauge factor is defined as the ratio of per unit change in resistance to per unit change in length.

Gauge factor $Gf = \Delta R/R/\Delta L/L$

13. Write about the gauge factors for different types of strain gauges?

The gauge factor of metal wire or foil strain gauges with the metals generally used is about 2.0. Silicon p – and n – type semiconductor strain gauges have gauge factors of about + 100 or more for p- type silicon and – 100 or more for n – type silicon.

14. What is the capacitance of a parallel plate capacitor?

The capacitance of a parallel plate capacitor is given by,

$C = \varepsilon A/d = \varepsilon_r \varepsilon_o A/d$

Where

ε = Permitivity of the medium/m

ε_r = Relative permitivity

ε_o = Permitivity of the free space = 8.85×10^{-12} F/m

A = Area of plates
D = Distance between two plates

15. Define LVDT?

The Linear Variable Differential Transformer consists of three coils symmetrically spaced along an insulated tube. The central coil is the primary coil and the other two are identical secondary coils, which are connected in series in such a way that their outputs oppose each other.

16. Determine the working Principle of LVDT?

When there is an alternating voltage input to the primary coil, alternating e.m.f.s are induced in the secondary coils. With the magnetic core central, the amount of magnetic material in each of the secondary coil is the same.

17. What are the uses of LVDT?

The uses are as follows.

a. Widely used as primary transducers for monitoring displacements.

b. Also used as secondary transducers in the measurement of force, weight and pressure.

18. Write about inductive proximity switch?

Inductive proximity switch consists of a coil wound round a core. When the end of the coil is close to a metal object is inductance changes. This change can be monitored by its effect on a resonant circuit and the change used to trigger a switch. It can only be used for the detection of metal objects and is best with ferrous metals.

19. What is an encoder?

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

20. What are the two types of position encoders?

The two types of position encoders are,

a. Incremental encoders

b. Absolute encoders.

21. What is an incremental encoder?

An incremental encoder is used for the measurement of angular displacement. A beam of light passes through slots in a disc and is detected by a suitable light sensor. When the disc is rotated, the sensor produces a pulsed output with the number of pulses being proportional to the angle through which the disc is rotated. Hence, the angular position of the disc is determined.

22. Write about absolute encoder?

An absolute encoder is used for the measurement of angular displacement. This gives an output in the form of a binary number of several digits, each such number representing a particular angular position. The rotating disc has three concentric circles of slots and three sensors to detect the light pulses.

23. What are the uses of photosensitive devices?

Photosensitive devices can be used to detect the presence of an opaque object by it breaking a beam of light or infrared radiation, falling on such a device or by detecting the light reflected back by the object.

24. Write about Hall effect sensors?

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.

25. What is Hall co-efficient?

The transverse potential difference is given by, V = KHBI

Where, b

KH = Hall co-efficient

B = Magnetic flux density at right angles to the plate,

I = Current

26. What are digital signals?

Digital signals are discrete time signals in that they are not continuous functions of time but exist at only discrete times.

27. Why the signal conditioning is required?

Signal conditioning of analogue signals requires components such as amplifiers filter circuits and digital signal microprocessor.

PART-B & PART-C

1.**Explain two types gear drives in mechatronics system. (MAY 2014)**

*Refer: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No from 547 to 549.*

2.**Explain construction and working principle of AC and DC motor. (MAY 2014, DEC 2013)**

*Refer: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No:265 to 274.*

3.**i) What is the principle and construction of vane pump and vane motor?**
ii) Describe the basic details of basic details of a 4/2 valve and 5/2 valve. (DEC 2013)

*Refer: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No from 109 to 114.*

4.**i)List the various types of bearing. Also mention their capabilities and applications.**
ii) Describe the working of an AC servo motor. (MAY 2013)

*: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No from 132 to133.*

5.i) Explain different types of cam and followers.
ii) A toothed gear has 72 teeth and circular pitch of 26mm, find pitch diameter, diametral pitch and module of the gear. (MAY 2013)

*Refer: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No from 142 to146.*

6.**With the help of proper control circuits explain the speed control of AC and DC motors. (DEC 2012)**

*Refer: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No from 182 to186.*

7.i) Using simple circuit explain the basic components required for a hydraulic actuation system.
ii) List the types of bearings and brief about each.(DEC 2012)

*Refer: "*RameshSGaonkar,"MicroprocessorArchitecture,Programming,andApplicationswiththe 8085*", Page No from 272 to273.*

UNITIII PROGRAMMABLEPERIPHERAL INTERFACE

Introduction–Architectureof8255,Keyboardinterfacing,LEDdisplay–interfacing,ADCandDAC interface, TemperatureControl–StepperMotorControl–Traffic Controlinterface.

PART-A

1. Define Actuator.

An actuator is an output device which performs useful works.

2. Classify actuator based on motion.

1. Linear motion
- Single acting cylinder
- Double acting cylinder

2. Rotary Motion

- Air motors
- Rotary actuators

3. Flow Control valve

3. When is cascade control Needed?

The need for cascade control will occur when a final control element experiences signal overlap i.e. when a trip valve mechanism is still held down , but the output signal has to been used and requires removal.

4.Write down the principles of cascade control.

- A simple design procedure to determine the minimum number of groups in the circuit
- Evolve separate supply bus for each group
- Arrange selector valves to divert the supply to whichever is the active group

5. Mention the various components of a hydraulic system.

- Motor
- Filter
- Pump
- Pressure Regulator
- Control Valve
- Piston and cylinder

6. What is called a pneumatic system?

System using gas for power transmission are called pneumatic systems and industrial system are usually based on air.

7. List down the components of pneumatic system.

- Motor driven compressor
- Air receiver
- Directional control
- Pneumatic cylinder

8. What is the purpose of using filters in the hydraulic systems?

Filters are used to prevent dirt or dust entering important elements of hydraulic system like valves, seals, etc. Filters are used to remove very finer particles.

9. What are the types of pumps used as energy source in a hydraulic system?

- Centrifugal Pump(Hydrodynamic Pumps)
- Positive displacement pump

1. Gear Pumps
2. Vane Pumps
3. Piston pumps

10. What are the factors to be considered for selecting compressors?

The type of air compressor is selected dependent on quality of air, pressure and cleanliness

11. What are the uses of air receiver?

An air receiver is used to store high pressure air and provide constant supply of air pressure in the pneumatic system regardless of varying and fluctuating consumption. It is used for the emergency supply of air to the system in case of power failure.

12. State the purpose of providing air dryers.

The aim is to reduce the temperature of the air to a dew point which ensures that the water in the air condenses and drops out easily.

13. State the function of a control valve.

The primary function of the control valve is to direct and regulate the flow of fluid from an energy source to

various loading devices. Normally the control valves are used for the purpose of sensing, processing, and controlling. They are used for:

- Allowing the passage of air/fluid and directing it to a loading line
- Cancel the signal by blocking its passage
- Alert or generate the signal
- Release the air to atmosphere or return the fluid to tank

14. List the different control valves.

- Directional control valve
- Non return valves
- Flow control valves
- Pressure control valves
- Combinational valves
- Solenoid valves

15. Define the term degrees of freedom.

The minimum number of independent displacement required to specify the system completely is called degrees of freedom

16. Define kinematic pair.

The two links or elements are joined together to form a pair. If the relative motion between them is completely or successfully constrained, the pair is known as kinematic pair.

17. When is cascade control needed?

The need for cascade control will occur when a final control element experiences signal overlap ie; when a trip valve mechanism is still held down, but the output signal has been use and requires removal.

18. List the features of synchronous motor.

- It operates at a current speed from no load to full load
- Power factor of the motor can be controlled easily

19. What is a stepper motor?

A stepper motor is a rotating machine which converts a DC voltage pulse into a series of discrete rotational steps. Each step position is an equilibrium position without further excitation, this makes it ideally suitable for the use with digital control

20. What is stepper motor?

A stepper motor is a device which transforms electrical pulses into equal increments of rotary shaft motion called steps.

21. What is servomotor?

The motors used in automatic control systems or in servomechanism are called servomotors. They are used to convert electrical signal into angular motion.

22. What is synchro?

A synchro is a device used to convert an angular motion to an electrical signal or vice versa.

23. At what conditions SPDT, DPST an DPDT switches are used?

a. SPDT (Single Pole, Double Throw): When we require ON and OFF operation as the circuit is actuated, SPDT is used.

b. DPST (Double Pole, Single Throw): When we need to turn two separate circuits ON and OFF simultaneously with a single switch, DPST is used.

c. DPDT (Double Pole, Double Throw): When a switch is turned ON and OFF between N and O with double pole switches, DPDT is used.

24. What are the factors to be considered for selecting solenoids?

a. The size of the mechanical load.

b. The movement distance of plunger.

c. The type of electrical connections.
d. The type of value of current and voltage.

25. What is the principle of relay?

Relay is used for many control functions and essentially an electro-mechanical switch. It uses basic switching principles and solenoid actuation.

26. What is zener voltage?

In the reverse direction, the diode conducts very little when the voltage is below the breakdown value. This critical limiting value of reverse voltage is known as Zener voltage

27. Name three output characteristics of transistor configuration.

a. Saturation region
b. Active region

PART-B& PART-C

1.Discuss Briefly model building block for automatic suspension system and electrical motor. **(NOV 2014, MAY 2013)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No:266 to 268 and from 271 to 272.*

2. Discuss briefly the following control modes.
a) PI controller
b) PID controller(MAY 2016, MAY 2015, MAY 2013, MAY 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 95 to 97.*

3.**i) Briefly explain ON OFF controllers and give their limitations.**
ii) Describe and applications of proportional controllers and their limitations.(NOV 2014, MAY 2013)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 95 to 97.*

4. i) Explain the system modeling of a chamber filled with fluid.

ii) Explain the various types of control modes.(MAY 2017, MAY 2016, MAY 2015)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 125 to 128.*

5. i) Explain briefly a mathematical model of a vehicle moving on a road.

ii) Explain in detail about digital controllers..(MAY 2013, MAY 2012, NOV 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 135 to 140.*

6. Explain the model building using the basic building blocks for a
i)Automobile suspension system
ii) Electrical motor.(MAY 2015, MAY 2012, NOV 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 205 to 207.*

7. Discuss in detail about PI and PD mode electronic controllers. (NOV 2017, MAY 2017)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 95 to 97.*

UNITIV PROGRAMMABLELOGICCONTROLLER

Introduction–Basicstructure– Inputandoutputprocessing–Programming–Mnemonics– Timers, countersandinternalrelays–DatahandlingSelectionofPLC.

PART-A

1. What is a 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. a. Microprocessor b. Memory

c. Input d. Output.

3. Define the terms. a) Bus b) RAM c) ROM.

BUS

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

RAM

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

ROM

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

4. What the types of languages used?

The types of languages used are,

a. Machine language

b. Assembly language

c. Low – level language

d. High – level language.

5. What is a machine language?

The binary medium of communication with a computer through a designed set of instructions specific to each computer.

6. What is a assembly language?

A medium of communication with a computer in which programs are written in mnemonics. An assembly language is specific to a given computer.

7. What is low – level language?

A medium of communication that is machine – dependent or specific to a given computer. The machine and the assembly language of a computer are considered low – level languages. Programs written in these languages are not transferable to different types of machines.

8. What is a high – level language?

A medium of communication that is independent of a given computer. Programs are written in English – lie words, and they can be executed on a machine using a translator (a compiler or an interpreter).

9. Differentiate a compiler and an interpreter?

Compiler – A program that translates English – like words of a high level language into the machine language of a computer. A compiler reads a given program, called a source code, in its entirety and then translated the program into the machine language, which is called an object code. Interpreter – A program that translates the English – like statements of a high – level language in to the machine language of a computer. An interpreter translates one statement at a time from a source code to an object code.

10. 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.

11. What are the types of bus?

The types of bus are,

a. Address bus

b. Data bus

c. Control bus.

12. Define the term , Data Bus, Address bus, Control Bus

a. 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.

b. 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.

c. Control bus

Single lines that are generated by the MPU to provide timing of various operations.

13. Write about the 16 – bit register of a 8085 microprocessor?

The 8085 has two 16 – bit register.

a. The program counter

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

14. What are the two types of memories?

The two types of memories are,

a. Static memory (SRAM)

b. Dynamic memory (DRAM)

15. Write about the SRAM?

a. This memory is made up of flip – flops, and it sores the bit as a voltage.

b. Each memory cell requires six transistors.

c. The memory chip has low density, but high speed.

d. More expensive, and consumes more power.

e. Also known as cache memory.

16. What are the advantages of DRAM?

The advantages of DRAM are,

a. This memory is made up of MOS transistor gates and it stores the bit as a charge.

b. It has high density.

c. Low power consumption

d. Cheaper than static memory

e. Economic to use when the system memory size is at least 8K for small systems.

17. What are the disadvantages of DRAM?

The disadvantages of DRAM are,

a. The charge (bit information) leaks.

b. Stored information needs to be read and written again every few milliseconds this is called refreshing the memory.

c. Requires extra circuitry, adding to the cost of the system.

18. What is 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 2was 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.

19. What are the interfacing devices?

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. The

interfacing devices are semiconductor chips that are needed to connect peripherals to the bus system.

20. Write about buffer?

The buffer is a logic circuit that amplifies the current or power. It has one input line and one output line. The logic level of the output is the same as that of the input, logic 1 input provides 1 output. The buffer is used primarily to increase the driving capability of a logic circuit. It is also known as driver.

21. Define looping?

The programming technique used to instruct the microprocessor to repeat tasks is called looping. A loop is set up by instructing the microprocessor to change the sequence of execution and perform the task again. This process is accomplished by using Jump instructions.

22. What are the types of loops?

Loops can be classified in to two groups. They are,

a. Continuous loop

b. Conditional loop.

23. Write about the continuous loop?

A continuous loop is a set up by using the unconditional jump instruction. A program with a continuous loop does not stop repeating the tasks until the system is reset.

24. Write about the conditional loop?

A conditional loop is set up by the conditional jump instructions. The instructions check flags (Zero, Carry etc.,) and repeat the specified tasks if the conditions are satisfied. These loops usually include counting and indexing.

25. What are the instructions of a 8085 instruction set for data transfer from memory to the microprocessor?

The 8085 instruction set includes three memory transfer instructions. They are,

a.MOV R,M : Move from Memory to Register

b.LDAX B/D : Load Accumulator Indirect

c.LDA 16 – bit : Load Accumulator Direct

26. What are the instructions of a 8085 instruction set for data transfer from microprocessor to the memory?

The 8085 instruction set includes three memory transfer instruction. They are,

a.MOV. R,M : Move from Memory to Register

b. STAX B / D : Store Accumulator Indirect

c. STA 16 – bit : Store Accumulator Direct

d. MVI M, 8 – bit : Load 8 – bit data in memory.

27. 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

28. What is dynamic debugging?

After the steps have been completed in the process of static debugging, and if the program still does not produce the expected output, attempt is made to debug the program by observing the execution of instructions. This is called dynamic debugging.

29. What are the tools used for dynamic debugging?

The tools used for dynamic debugging are,

a. Single step

b. Register examine

c. Break point.

30. Write about single step?

The single step key on a keyboard allows to execute one instruction at a time, and to observe the results following each instruction. Generally, a single-step facility is built with a hard-wired logic circuit. When the single step key is pushed, addresses and codes are observed as they are executed.

PART-B& PART-C

1.i) Explain the configuration of PLC.

ii) Give advantages of PLC system over traditional mechanical system.**(MAY 2015, MAY 2016)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*",Page No: from 311 to 317.*

2.Explain the following

a) Registers

b) Counters

c) Internal Relays

d) Timers. (NOV 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No: from 460 to 472.*

3.**Explain the basic structure of PLC.(NOV 2017, MAY 2017, MAY 2015, MAY 2014)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 431 to 445.*

4.**Explain the following**

a) Registers

b) Counters

c) Internal Relays(NOV 2017, MAY 2017, MAY 2013, MAY 2012, NOV 2012)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 409 to 415.*

5.Device a PLC circuit for the following application: Consider a conveyor belt that is to be used to transport goods from a loading machine to a packaging area. When item is loaded into the conveyor belt, a contact switch might be used to indicate that the item is on the belt and start the conveyor motor. The motor then has to keep running until the item reaches the far end of the conveyor and falls off into the packaging area. When it does this, a switch might be activating which has the effect of switching of the conveyor motor. The motor is then to remain off until the next item is loaded onto the belt.(MAY 2016)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 406 to 409 and from 416 to 421.*

6."Device PLC circuit for the following application : Consider a simple goods lift to move items from one level to another. The lift is to move upwards when a push button is pressed at the ground level to send the lift upwards or a push button is pressed at the upper level to request the lift to move upwards but in both cases there is a condition that has to be met that a limit switch indicates that the access gate to the lift platform is closed.. (MAY 2017)

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No: 374 to 380.*

UNIT V ACTUATORSAND MECHATRONIC SYSTEMDESIGN

TypesofStepperandServomotors–Construction– WorkingPrinciple–Advantagesand Disadvantages.Design process-stages ofdesignprocess– TraditionalandMechatronicsdesign concepts–Case studies ofMechatronics systems–Pickand place Robot–Engine Management system–Automaticcarparkbarrier.

PART-A

1. Write about the input / output channels?

The input/output channels provide signal conditioning and isolation functions so that sensors and actuators can be generally directly connected to them without the need for other circuitry. Common input voltages are 5 V and 24V. Common output voltages are 24 V and 240 V.

2. Write about the relay?

With the relay type, the signal from the PLC output is used to operate a relay and so is able to switch

currents of the order of a few amperes in an external circuit. The relay isolates the PLC from the external circuit and can be used for both D.C. and A.C. switching. Relays are, however, relatively slow to operate.

3. What are opto isolators?

Opto isolators are used with transistor switches to provide isolation between the external circuit and the PLC. They are also used to provide isolation.

4. What are the methods used for input / output processing?

There are two methods used for input / output processing. They are

a. Continuous updating

b. Mass input/output copying.

5. What is continuous updating?

This involves the CPU scanning the input channels as they occur in the program instructions. Each input point is examined individually and its effect on the program determined. Each input is scanned with a 3 ms delay, before the program has the instruction for a logic operation to be executed and an output to occur. This process is called continuous updating.

6. What is the disadvantage of continuous updating?

Because of the 3 ms delay in the continuous updating on each input, the time taken to examine several hundred input/output points can become comparatively long.

7. Write about the mass input/output copying?

To allow a more rapid execution of a program, a specific area of RAM is used as a buffer store between the control logic and the input/output unit. At the start of each program cycle the CPU scans all the inputs and copies their status into the input/output address in RAM. At the end of each program cycle all the outputs are transferred from RAM to the output channels. The outputs are latched so that they retain their status until the next updating.

8. What is a LATCH circuit?

The term latch circuit is used for the circuit used to carry out such an operation. It is a self – maintaining circuit in that, after being energized, it maintains that state until another input is received. It remembers its last state.

9. Define the term point and delay–on?

The term point is used for a data point and so is a timing, marker (internal relay) or counter element. Thus, the 16 points for timers means that there are 16 timer circuits. The term delay on is used to indicate that this type of timer waits for a fixed delay period before turning on.

10. Write about timer circuit?

A timer circuit is specified by stating the interval to be times and the conditions or events that are to start and / or stop the timer. They are commonly regarded as delays with coils which, when energized, result in the closing or opening of input contacts after some preset time.

11. Write about internal relays?

The term internal relay, auxiliary relay or marker is used for what can be considered as an internal relay in the PLC. These behave like relays with their associated contacts, but in reality are not actual relays with their associated by the software of the PLC. Internal relays are often used when there are programs with multiple input conditions.

12. Write about counters?

Counters are used when there is a need to count a specified number of contact operations. Example – where items pass along a conveyor into boxes, and when the specified number of items has passed into a box the next item is diverted into another box.

13 What is an up counter?

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

14. What is a down counter?

Down counter means that the computer counts down from the preset value to zero i.e., events are subtracted from the set value. When zero is reached the counters contact changes state.

15. Write about shift register?

The term shift register is used because the bits can be shifted along by one bit when there is a suitable input to the register.

16. What are the inputs of shift register?

There are three inputs of shift register. They are,

a. One to load data into the first element of the register (OUT).

b. One as the shift command (SFT).

c. One for resetting (RST).

17. What the operations that are carried out with a PLC on data words?

The operations that are carried out with a PLC on data words are,

a. Moving data

b. Comparison of magnitudes of data

c. Arithmetic operations such as addition and subtraction

d. Conversions between binary coded decimal (BCD), binary and octal.

18. What is the criteria need for the selection of a PLC?

The criteria needed for the selection of a PLC are the following.

a. Input/output capacity is required.

b. Types of inputs/outputs are required.

c. Size of memory required.

d. Speed and power is required for the CPU.

19. What are the numbers of stages in the design process?

The design process can be considered as a number of stages. They are,

a. The need

b. Analysis of the problem

c. Preparation of a specification

d. Generation of possible solutions

e. Selections of a suitable solution

f. Production of a detailed design

g. Production of working drawings.

20. What are the advantages of the microprocessor controlled system?

The microprocessor controlled system can cope easily with giving precision and programmed control. The system is much more flexible. This improvement in flexibility is a common characteristic of Mechatronics systems when compared with traditional systems.

21. What is the advantage of using PLC solution over mechanical solution?

A PLC solution could involve the arrangement with the given ladder program. This would have the advantage over the rotating cam of having off and on times which can be adjusted by purely changing the timer preset values in the program whereas a different cam is needed if the times have to be changed with the mechanical solution.

22. What are the axes of a pick and place robot?

The robot has three axes about which motion can occur.

a. Rotation in a clockwise or counter clockwise direction of the unit on its base.

b. Arm extension or contraction and arm up or down.

c. Gripper can open or close.

23. How do the movements of robot take place?

Clockwise rotation of the unit might result from the piston in a cylinder being extended and the counter clockwise direction by its retraction. Likewise the upward movement of the arm might result from the piston in a linear cylinder being extended and the downward motion from it retracting, the extension of the arm by the piston in another cylinder extending and its return movement by the piston retracting.

24. What is the use of PLC in automatic car park system?

An illustration of the use of a PLC in the coin operated barriers for a car park. The in-barrier is to open when the correct money is inserted in the collection box and the out – barrier is to open when a car is detected at the car park side of the barrier.

25. How does a car park barrier works?

When a current flows through the solenoid of valve, the piston in a cylinder moves upwards and causes the barrier to rotate about its pivot and rise to let a car through.

26. Write about the engine speed sensor?

The engine speed sensor is an inductive sensor and consists of a coil for which the inductance changes as the teeth of the sensor wheel pass it and so results in an oscillating voltage.

26. How is the voltage produced by the oxygen sensor?

The oxygen sensor is generally a closed – end tube made of zirconium oxide with porous platinum electrodes on the inner and outer surfaces. Above about 300^0C, the sensor becomes permeable to oxygen ions with the result that a voltage is produced between the electrodes.

27. Give some applications of microprocessor.

The examples of the microprocessor are,

a. Microprocessor Controlled Temperature System (MCTS)

b. Stepper motor control.

c. Traffic light controller.

PART-B& PART-C

1. **Explain about the mechanical system design of an automatic car park barrier.(MAY 2017, MAY 2011)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 488 to 491.*

2.**Explain about the various functional components in wireless surveillance balloon system**.**(NOV 2017, MAY 2015, MAY 2013, MAY 2012)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 321 to 335.*

3.**Discuss the mechatronic design of the pick and place robot with a neat control circuit.(MAY 2016, MAY 2015)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*",Page No from 386 to 391.*

4.**Explain the design of a mechatronic system used in a engine management system(MAY 2016, MAY 2012, MAY 2011)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 526 to 530.*

5.**Explain with a neat circuit, the control system and the communication system used in the wireless surveillance balloon**. **(NOV 2011)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", from Page No 516 to 525.*

6.**Detail about the various functional components in a wireless surveillance balloon system (NOV 2017, MAY 2017, MAY 2016, MAY 2015)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008.*", Page No from 497 to 498.*

7.**Discuss mechatronic design of an automatic car parking system**. **(NOV 2011)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 321 to 330.*

8.**Discuss the mechatronic design of the pick and place robot with a neat control circuit.(NOV 2011)**

*Refer: "*Bolton, "Mechatronics",PrinticeHall,2008*", Page No from 341 to 343.*