



KINGS

COLLEGE OF ENGINEERING



DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

Sub Code/Name: ME 1402 Mechatronics

Year/Sem: IV / VII

UNIT-I
MECHATRONICS, SENSORS, TRANSDUSERS
PART-A

1. Define mechatronics and sketch the graphical representation of mechatronics system?
2. What are the basic elements of a measurement system and sketch its block diagram?
3. How do you define a sensor?
4. State the difference between primary and secondary transducer?
5. Define the terms accuracy & precision?
6. A quartz piezoelectric crystal having a thickness of 2mm and voltage sensitivity $0.055 \text{ Vm} \setminus \text{N}$ is subjected to a pressure of $1.38 \times 10^6 \text{ N/m}^2$. Calculate the voltage output.
7. What is hysteresis?
8. State the dynamic characteristics of a simplified measuring system?
9. Distinguish between theoretical and practical sensors?
10. Write the working principle of a hot wire anemometer?

PART-B

1. Write a detailed note on a pressure measuring system & a pressure measuring transducer.
2. Explain in detail about the characteristics of fluid flow and the measurement of fluid velocity?

3. Explain the following
 - a) Thermo electric thermometry.
 - b) Thermo resistive elements
 - c) Thermocouple

4. Briefly explain any two mechantronics system with example?
Explain the following terms.
 - a) Sensitivity.
 - b) Hysteresis.
 - c) Stability and resolution

5. a) Describe the rotary type potentiometer?
b) How is the capacitance measurement used for displacement?

6. Explain the working principle of following sensors
 - a) Fiezo electric sensor.
 - b) Thermocouples.

UNIT-II
ACTUATION SYSTEM
PART-A

1. Suggest suitable actuator for robot arm joint and justify.
2. A hydraulic cylinder is to be used to move a work piece through a distance Of 60mm in 20 seconds. A force of 15 KN is required to move the work piece. Determine the required hydraulic liquid flow rate if a cylinder with a piston diameter of 75mm is available.
3. What is the function of the stack pointer register?
4. What is ALU in a microprocessor and its function?
5. Why sequential valves are necessary in pneumatic system?
6. What in meant by cylinder sequencing?

7. What is MOSFET? State its features?
8. What are the factors considered for selecting solenoid?
9. State the objectives of DCVs ? Classify them?

PART-B

1. Discuss about the following actuation system?
 - i. Self- excited wound field shunt configuration dc motor.
 - ii. Self- excited wound field series configuration dc motor.
 - iii. Stepper motor.
 - iv. Induction motor.
2. What are the common types of registers of microprocessor and explain them?
3.
 - (i) what are the function of interfacing circuits ?
 - (ii) Explain the difference between a parallel and serial interface?
 - (iii) Explain the term handshaking in microprocessor?
4. A flat belt, 7mm thick and 95mm wide transmits power between two Pulleys running at 1500 m/ min. The mass of the belt is 0.85kg /m length. The angle of lap in the smaller pulley is 155 degree and the coefficient of Friction between the belt and pulley is 0.25 If the maximum permissible Stress in the belt is 2 MN/ m find the maximum power transmitted and Initial tension in the belt.
5. Explain SCR and the ways to turn an SCR?

UNIT III
SYSTEM MODELS AND CONTROLLER

PART-A

01. Derive the equation for a translational mechanical system model with spring & mass?
02. Given an example for 2 step mode control unit?
03. Define transfer function?
04. How is stability defined in youth-Hurwitz method?
05. What are MRAC?
06. Mention various features in digital controllers?
07. How are micro controller describe?
08. Write short notes on programming counter register?
09. List down the various task prepared by I/O interface?
10. List out the application of logic gates?
11. Define encoding & decoding process?
12. What are Boolean algebra & Boolean numbers?

PART-B

01. Explain the features of proportional controller?
 - (a) PI controller
 - (b) PID controller

02. Give the relationship for heat flow across the substance & heat storage in substance?

03. A hot object with capacitance C and temp. T cools in large room at temp. T_a . If the thermal system resistance R derives an equation describing how the temperature of the hot object changes with time and given an electrical analog the system?

04. Propose a model for a stepped shaft used to rotate a mass and derive an equation relating the input torque, and angular rotation. Neglect the damping effect?

UNIT-IV
PROGRAMMABLE LOGIC CONTROLLERS

PART-A

1. Mention the two specific features of PLC?
2. What is latching in PLCs?
3. State the function of counter?
4. Draw the ladder logic diagram to represent two switches that are normally open and both have to be closed for a motor to operate?
5. Device timing circuits that will switch on output on for one second then off for 20 sec, then on for one sec, and then off for 20 sec and so on?
6. What is meant by program scan?
7. List down the different types of timer?
8. What are shift register. Where they are used?
9. What are factors to be considered for selecting PLC?
10. State two methods of input/output processing and explain briefly?

PART – B

1. Sketch the basic architecture of a PLC and explain the function of each element?
2. (a) Explain how a PLC can be used to handle an analog input?

(b) Draw the ladder diagram to represent
 - (1) two switches are normally open and both have to be closed for a motor to operate.
 - (2) Either of two, normally open switches have to be closed for a coil to be energized and operate an actuator?
 - (3) A motor is switched on by pressing a spring return bush button start switch and the motor remains on until another spring return bush button stop switch is pressed?

3. Device a system using PLC that could be used with a conveyor belt which is used to move an item at the workstation. The presence of the item at the workstation is detected by means of breaking a contact activated by a beam of light to a photo sensor. There it stops for 100 sec for a operation to be carried out and then starts moving. The motor for the belt is started by a normally open start switch and stopped by a normally closed switch?
4. Device a circuit that could be used with a domestic washing machine to switch on a pump to pump water for 100sec into a machine .then switch off the pump and switch on heater for 50 sec to heat the water . The heater is then switched off and another pump is switched on for 100 sec to empty the water from the machine.
5. What are the logic functions used for switches in series and in parallel?

UNIT-V

DESIGN OF MECHATRONICS SYSTEM

PART-A

1. Mention the stages in designing a mechatronics system?
2. Distinguish between traditional design approach and mechatronics approach?
3. How a traditional design of temperature control of domestic central heating system is improved by mechatronics design?
4. What are the various movements of robots?
5. What are the uses of sensors? List out the various sensors used in engine management system?
6. Distinguish between machine language program and assembly language program?
7. Discuss mechatronics design of an automotive car parking system?
8. What is an engine management? List out the various sensors involved in engine management system?
9. What are the configurations in operating stepper motor?
10. What are the advantages of PLC system?

PART-B

1. What are the various stages in designing a mechatronics system- Explain.
 2. Design hardware to interface segment LEDs with 8085 microprocessor. Write software to display numbers from 0 to 9 continuously with suitable delay time.
 3. Explain the design of mechatronics system used in an engine management system.
 4. Discuss the design aspects of a pick and place robot in terms of the various mechatronics system involved.
 5. Considering a computer controlled machine tool (CNC machine tool) as a mechatronics system. Discuss the design considerations and design solutions to those considerations.
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