

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
Seventh Semester B.Tech Degree Supplementary Examination August 2021



**Course Code: ME407**  
**Course Name: MECHATRONICS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any three full questions, each carries 10 marks.*

Marks

- |   |   |      |
|---|---|------|
| 1 | a) Illustrate the working of two modes in an ultrasonic proximity sensor.   | (7)  |
|   | Comment on the dead band of an ultrasonic proximity sensor.   |      |
|   | b) Graphically represent the method to find out the non-linearity error.  | (3)  |
| 2 | a) Distinguish between incremental and absolute encoders with neat sketches.  | (7)  |
|   | b) Compare binary and grey code encoders  | (3)  |
| 3 | a) With a neat sketch illustrate the function of cylinder end cushioning  | (5)  |
|   | b) Illustrate the working of spool valve and poppet valve with a neat sketch  | (5)  |
| 4 | A plastic component is to be embossed by using a die which is powered by a double acting cylinder. The return of the die is to be effected when the cylinder rod has fully extended to the embossing position and the preset pressure is reached. A roller lever valve is to be used to confirm full extension. The signal for retracting must only be generated when the piston rod has reached the embossing position. The pressure in the piston chamber is indicated by a pressure gauge. Design a pneumatic circuit for the above-mentioned application. | (10) |

**PART B**

*Answer any three full questions, each carries 10 marks.*

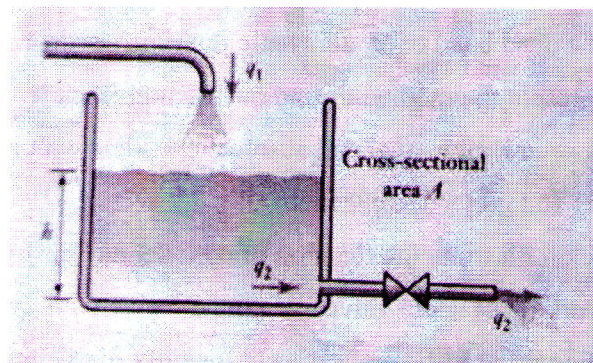
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|---|--|-----|
| 5 | a) Distinguish between positive and negative photoresist   | (2) |
|   | b) Illustrate the processing sequence in photolithography for micro fabrication with neat sketch.              | (8) |
| 6 | a) With a neat sketch explain any one method of vapour synthesis in PVD  | (5) |
|   | b) Explain Deep Reactive Ion Etching. What are the advantages of dry plasma etching over wet chemical etching? | (5) |
| 7 | a) Explain the stick slip phenomenon.  | (3) |

- b) Illustrate the working of recirculating ball screw with neat sketch. (5)
- c) What are the advantages of recirculating ball screw? (2)
- 8 Design a PLC ladder program to enable a three-cylinder, double solenoid-controlled arrangement to give the sequence A+, A-, A+, A-, A+, A-, B+, C+, B-, C-. The A+, A- sequence has to be repeated three times before B+, C+, B-, C- occur. Explain the logic used. (10)

**PART C**

*Answer any four full questions, each carries 10 marks.*

- 9 a) Derive the mathematical model for a thermometer at temperature T which has been inserted into a liquid at temperature  $T_L$ . Show how the temperature T vary with respect to time. (5)
- b) Derive the mathematical model for the fluid system shown in the figure. (5)



- 10 a) Illustrate the constructional features and working of harmonic drive with neat sketch. List out its applications. (8)
- b) What are the advantages of harmonic drive? (2)
- 11 a) What are the different types of stepper motor? Explain the working of any one type with a sketch. (5)
- b) Explain any one principle of measurement used by laser-based range finder. (5)
- 12 a) Illustrate the working of Vidicon camera with neat sketch. (5)
- b) Illustrate the working of CCD with neat sketch. (5)
- 13 a) What are the important functions of a machine vision system? (3)
- b) Explain how thresholding is used for segmentation in industrial vision applications. (7)
- 14 Describe the different mechatronics systems used in the modern automobile engine management system. (10)

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