

**B.Tech. MECHANICAL ENGINEERING  
(COMPUTER INTEGRATED MANUFACTURING) /  
B.Tech. AEROSPACE ENGINEERING (BTAE)**

**Term-End Examination**

**June, 2015**

00511

**BME-006 : MECHATRONICS**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt any seven questions. All questions carry equal marks. Use of scientific calculator is permitted.*

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1. (a) Identify the sensor, signal conditioner and display elements in the measurement system of a mercury-in-glass thermometer.
- (b) Identify the various elements that might be present in a control system involving a thermostatically controlled electric heater. *2×5=10*
2. (a) Explain the functions of a programmable logic controller.
- (b) State the steps that might be present in the sequential control of a dishwasher. *2×5=10*

3. (a) How does a microcontroller differ from a microprocessor ?
- (b) Apply the Hurwitz-Routh criterion to determine the stability of the systems whose characteristic equation is given by

$$s^5 + 9s^4 + 2s^2 + 10s - 20 = 0. \quad 2 \times 5 = 10$$

4. (a) For the following system, as shown in Figure 1, the weight is guided so that only vertical motion without swinging is possible. Obtain the differential equation representing this system.

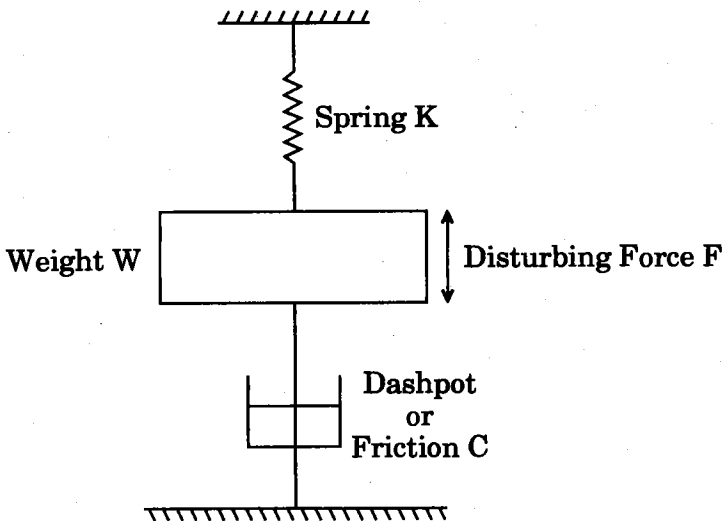


Figure 1

- (b) Find the inverse Laplace transforms of

$$\frac{s + 2}{s^2 - 4s + 13}. \quad 2 \times 5 = 10$$

5. (a) Determine the binary equivalent of  $(231)_8$ .
- (b) What is a proximity switch ? Describe in detail, all its industrial applications.  $2 \times 5 = 10$
6. (a) Describe any four different sensing modes for photoelectric sensors.
- (b) Explain the working principles of a relay with the help of a schematic diagram.  $2 \times 5 = 10$
7. (a) What are the two types of data transfer techniques used in computer interfacing ? List out the main differences between them.
- (b) Describe and compare the characteristics of proportional plus integral plus derivative control.  $2 \times 5 = 10$
8. (a) What are the advantages of hydraulic actuators over mechanical actuators ?
- (b) With the help of a neat sketch, describe, how the hydraulic system can be used to amplify force.  $2 \times 5 = 10$
9. (a) Define the term "Process Control". Explain with a block diagram the process control system.
- (b) A temperature probe having a first-order response with a time constant of 1 second is given a step input of  $50^\circ\text{C}$  from  $0^\circ\text{C}$ . Calculate the temperature indicated 0.6 second after the application of the input.  $2 \times 5 = 10$

10. Write short notes on any *five* of the following : 5×2=10

- (a) Robot
  - (b) Tactile Sensing
  - (c) Fuzzy Logic
  - (d) Accuracy
  - (e) Accelerometer
  - (f) Amplifier
  - (g) Viscosity
  - (h) Diode
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