

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

**Term-End Examination**

**December, 2018**

**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 Bourdon pressure gauge.
- (b) Explain with examples the difference between open-loop and closed-loop control systems. 5+5
  
2. (a) What are the advantages and limitations of hydraulic systems over pneumatic systems ?
- (b) Explain the working principle of wrist sensors with the help of neat sketches. 5+5

3. (a) A 6-bit D/A converter gives an output voltage of 15.750 volts for an input of 010101. What is the step size, the full range voltage and the percentage resolution ?

(b) Apply the Routh-Hurwitz criterion to determine the stability of the system whose characteristic equation is given by

$$s^5 + 5s^4 + 10s^3 - 6s^2 + 12s - 30 = 0. \quad 5+5$$

4. (a) Draw a block diagram of a basic microcontroller and explain the function of each subsystem.

(b) What are the logic functions used for switches

(i) in series, and

(ii) in parallel ? 5+5

5. (a) What are the main advantages of a capacitive proximity switch over the inductive proximity switch ?

(b) State with examples the advantages and disadvantages of ball screw over power screw. 5+5

6. (a) A double acting cylinder has a pressure of 40 bars acting on both sides. The cross-sectional areas of the two sides are  $200 \text{ cm}^2$  and  $100 \text{ cm}^2$ . Find out the net load against which the cylinder can operate. If a pressure compensated flow control valve is put in the return line which allows only a flow of 10 litre/min through it, at what speed will the cylinder move ?
- (b) Prove that the z-transform of a unit step function is  $\frac{z}{z-1}$ . 5+5
7. (a) Explain the working principle of relay with the help of a schematic diagram.
- (b) What do you mean by inverse kinematics ? Briefly explain the importance of path planning. 5+5
8. (a) An inverting amplifier has an input resistance of  $2 \text{ k}\Omega$ . Determine the feedback resistance needed to give a voltage gain of 100.
- (b) Explain the working and draw the symbols for a pressure relief valve which has actuators of a push-button and a spring. 5+5

9. (a) Explain the working principle of the brushless d.c. permanent magnetic motor.

(b) Draw and explain the ladder logic to represent two switches which are normally open and both have to be closed for a motor to operate. 5+5

10. (a) Determine the octal equivalent of  $(2B6)_{16}$ .

(b) Determine the decimal equivalent of  $(10110011)_2$ . 5+5

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