

00294

**BACHELOR OF TECHNOLOGY IN
MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)**

Term-End Examination

June, 2010

BME-006 : MECHATRONICS

Time : 3 hours

Maximum Marks : 70

Note : Answer any seven questions. Use of calculator is allowed.

1. (a) Explain briefly the principles of operation of limit switch, proximity switch and photoelectric sensors. 2x5=10
- (b) What is the difference between a thermocouple and a thermistor ?

2. (a) Describe four different sensing modes for photoelectric sensors. 2x5=10
- (b) Explain the following force or pressure transducer :
 - (i) load cells
 - (ii) strain gauges

3. (a) Describe in brief the method of eliminating backlash in a ball screw. $2 \times 5 = 10$
- (b) Discuss the relative advantages and disadvantages of the pneumatic system over hydraulic system.
4. (a) List the methods by which the efficiency of a reciprocating compressor can be improved. $2 \times 5 = 10$
- (b) Differentiate between a pressure relief valve and a pressure reducing valve.
5. (a) Describe different types of accumulator with their relative advantages and disadvantages. $2 \times 5 = 10$
- (b) A linear second-order, single-degree-of-freedom system has a mass of 10 gm and a stiffness of 1200 N/m. Calculate the natural frequency of the system. Determine the damping constant necessary to just prevent overshoot in response to a step input of force.
6. (a) Describe various methods of speed control of a DC motor. $2 \times 5 = 10$
- (b) A 6-bit D/A converter gives an output voltage of 10.000 volts for an input of 011001. What is the step size, the full range voltage and the percentage resolution ?

7. (a) Differentiate between open loop and closed loop control system ? **2x5=10**
- (b) A DC motor takes an armature current of 125 A at 485 V. The resistance of armature circuit is 0.24Ω . The machine has six poles and the armature is lap connected with 864 conductors. The flux per pole is 0.6 Wb. Calculate :
- (i) the speed, and
- (ii) the gross torque developed by the system.
8. (a) Describe the basic operation of a PID control loop with the help of block diagram. **2x5=10**
- (b) What is the main difference between ladder logic and relay logic ?
9. (a) What is GRAFCET ? What are the advantages of GRAFCET over ladder logic ? **2x5=10**
- (b) An accumulator of volume 120 litres is pre-charged to a pressure of 120 bar. It is put in a hydraulic system operating at a pressure of 180 bar. Its accumulator has to supply 17 litres of oil due to sudden demand in the system, what will be the drop in system pressure ?

10. Write short notes on any four of the following :

- (a) Float transducer **4x2½=10**
 - (b) CAMS and Followers
 - (c) Diode
 - (d) Gear Pump
 - (e) Servo Valve
 - (f) Timers
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