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BIME-016

**B.Tech. – VIEP – MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

December, 2015

BIME-016 : MECHATRONICS

Time : 3 hours

Maximum Marks : 70

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

1. (a) Identify the sensor, signal conditioner, and display elements in the measurement systems of a mercury-in-glass thermometer.
- (b) Explain the difference between open-loop and closed-loop control systems with the help of examples. 5+5
2. (a) Explain what is meant by sequential control and illustrate your answer by an example.

(b) Explain the significance of the following information given in the specification of transducers :

(i) A piezoelectric accelerometer :

Non-linearity : $\pm 0.5\%$ of full range

(ii) Thermocouple :

Sensitivity : nickel chromium – nickel aluminium thermocouple

0.039 mV/°C when the cold junction is at 0°C.

5+5

3. (a) An inverting amplifier has an input resistance of 2 k Ω . Determine the feedback resistance needed to give a voltage gain of 100.

(b) Explain the working and draw the symbols for (i) a pressure relief valve, and (ii) a 2/2 valve which has actuators of a push-button and a spring.

5+5

4. (a) Describe the principle of working of pilot operated valve.

(b) A force of 400 N is required to open a process control valve. What area of diaphragm will be needed with a diaphragm actuator to open the valve with a control gauge pressure of 70 kPa ?

5+5

5. (a) A hydraulic cylinder is to be used to move a work-piece in a manufacturing operation through a distance of 50 mm in 10 sec. A force of 10 kN is required to move the work-piece. Determine the required working pressure and hydraulic liquid flow rate, if a cylinder with a piston diameter of 100 mm is available.
- (b) Explain the principle of the brushless d.c. permanent magnet motor. 6+4
6. (a) Explain, for a microprocessor, the roles of
- (i) accumulator,
 - (ii) status,
 - (iii) memory address, and
 - (iv) program counter registers.
- (b) How does a microcontroller differ from a microprocessor ? Explain with respect to specific applications. 5+5
7. (a) Draw the ladder rungs to represent two switches which are normally open and both have to be closed for a motor to operate.
- (b) What are the major advantages of Non-Destructive Testing ? State some main NDT and their fields of application. 5+5

8. (a) State whether the following statements are *True* (T) or *False* (F) :

- (i) Brinell test is done to assess the hardness of a metal.
- (ii) Radiography can be done using X-rays or γ -rays (both).
- (iii) Radiography is a cheaper NDT.
- (iv) Surface roughness assessment uses a capacitance probe.
- (v) Magnetic particle inspection can be done on ferromagnetic materials only.

(b) How do you classify transducers ? Describe the working of any type of transducer. Also list out some industrial applications of transducers.

5+5