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BME-006

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

Term-End Examination

0 1 0 5

December, 2014

BME-006 : MECHATRONICS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Identify the sensor, signal conditioner and display elements in the measurement system of a Bourdon pressure gauge. *5*

(b) Explain the difference between open- and closed-loop control system. *5*

2. (a) Explain what is meant by sequential control and illustrate your answer by an example. *5*

(b) Compare and contrast the traditional design of a watch with that of the mechatronics-designed product involving micro-processor. *5*

3. (a) Draw a block diagram of a basic micro-controller and explain the function of each subsystem. *5*

(b) What are the logic functions used for switches (i) in series and (ii) in parallel ? *5*

4. (a) Apply the Hurwitz-Routh criterion to determine the stability of the system whose characteristics equation is given by

$$s^5 + 6s^4 + 9s^3 - 4s^2 + 11s - 20 = 0.$$ *5*

(b) Find the inverse Laplace transforms of

$$\frac{s^2 - 3s + 4}{s^3}$$ *5*

5. (a) How do you classify transducers ? Describe the working of any one type of transducer. Also list out some industrial applications of transducers. *5*

(b) What is a sensor ? Explain active and passive sensors. Also list out the basic requirements of sensors. *5*

6. (a) A 6-bit D/A converter gives an output voltage of 17·250 volts for an input of 010111. What is the step size, the full range voltage and the percentage resolution ? *5*

(b) Determine the octal equivalent of

$(432267)_{10}$. *5*

7. (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 cm^2 and 100 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 ? *5*

(b) Prove that the z-transform of a unit step function is $\frac{z}{z-1}$. *5*

8. (a) A DC motor taken an armature current of 100 A at 480 V. The resistance of the armature circuit is 0·2 Ω. The machine has six poles and the armature is lap connected with 864 conductors. The flux per pole is 0·5 Wb. Calculate the following : *5*

(i) The speed

(ii) The gross torque developed by the system

(b) Describe the basic principles of stepper-motors and servo-motors. *5*

9. (a) Explain the working principle of relay with the help of a schematic diagram. *5*

(b) What do you mean by inverse kinematics ? Briefly explain the importance of path planning. *5*

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

(i) Digital-to-Analog Converter

(ii) Error Signal

(iii) Simulation

(iv) Bit

(v) Modem

(vi) Ladder Diagram

(vii) EPROM

(viii) Indicator Lamp