G 1710 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Eighth Semester

Branch : Electronics and Communication Engineering

EC 010 805 G03—MECHATRONICS–Elective IV (EC)

(New scheme—2010 Admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Define mechatronics system. Indicate constituents of a mechatronics system graphically.
2. Differentiate between active and passive sensors.
3. Differentiate between span and range of a transducer.
4. What do you mean a second order system ? Explain.
5. List the salient features of Model Reference Adaptive Control with a block diagram.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Compare the similarities and differences between traditionally designed system with a mechatronics system.
7. Discuss the control of vibration using magnetostrictive transducers.
8. Describe the construction and working of 'Sequence valve' with a neat sketch.
9. Explain the relevance of rise time, settling time and overshoot in a typical control system with a suitable plot.
10. With a neat schematic and block diagram, explain the control of water level in a tank with proportional control.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (a) Discuss the modular approach to mechatronics design with Suitable example.

(6 marks)

(b) Develop a model for a hydraulic system where liquid entering the tank at rate $q1$ and leaving at rate $q2$ through a valve.

(6 marks)

Or

12. Create a bond graph model of spring mass damper system. (12 marks)

13. (a) Discuss the principle of working of thermocouple. Classify thermocouple based on material pairs.

(6 marks)

(b) Discuss the following sensor characteristics: Sensitivity, Repeatability and Linearity.

(6 marks)

Or

14. With a neat sketch explain the working of following sensors :

(i) Tactile sensor.

(ii) Ultrasonic flow sensor.

(iii) Piezo electric pressure sensor.

(12 marks)

15. (a) Explain various methods of valve actuation employed in hydraulic systems.

(6 marks)

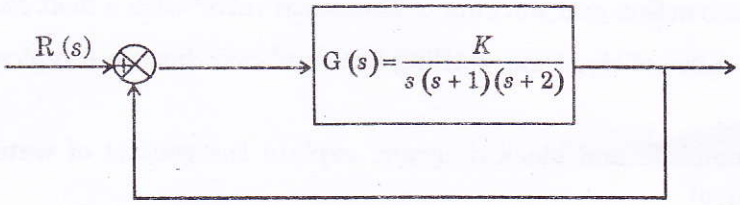
(b) Discuss the working of piezo-electric actuator with a neat sketch. (6 marks)

Or

16. (a) Explain the principle of working of op-amp as an inverting amplifier. (6 marks)

(b) Discuss the working of hydraulic actuation system with a neat schematic. (6 marks)

17. Consider the system given :



$G(s) = \dfrac{K}{s(s+1)(s+2)}$, $H(s) = 1$. We assume the value of K is non-negative. For this system sketch the root locus plot and then determine the value of K so that the damping ratio ζ of a pair of dominant complex conjugate closed loop poles is 0.5.

(12 marks)

Or

18. Explain how to draw magnitude and phase plot of a first order system along with the description of various parameters.

(12 marks)

19. (a) Explain process reaction method for controller tuning. (6 marks)

(b) Discuss any *two* material technologies used for the manufacture of micro sensors.

(6 marks)

Or

20. (a) List different sensors used for condition monitoring along with their application.

(4 marks)

(b) Explain the control of tool movements in a 3-axes CNC system.

(8 marks)

[5 × 12 = 60 marks]