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**Second Semester M.Tech. Degree Examination, June/July 2011**  
**Mechatronics System Design**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions.**

- 1 Discuss the basics of measurement systems and open and closed loop control systems. (20 Marks)
- 2 a. Illustrate the different control valve actuation symbols used in pneumatic and hydraulic systems. (05 Marks)  
b. Discuss the application of valves in a pneumatic lift system. (10 Marks)  
c. With reference to mechanical actuation system, illustrate the different types of cam followers. (05 Marks)
- 3 Illustrate the following mechanical system building blocks :  
Spring, dashpot, mass, spring – dashpot – mass system. (20 Marks)
- 4 a. Illustrate the functional relationship of the components of a microsystem. (05 Marks)  
b. Discuss with a diagram, an intelligent microsystem. (12 Marks)  
c. Discuss the evolution of microfabrication processes. (03 Marks)
- 5 a. Single crystal silicon is the most widely used substrate material for MEMS and microsystem. Discuss the reasons for its popularity for such applications. (08 Marks)  
b. Illustrate the Czochralski method for growing single crystals. Also, mention the size of the circular pure crystal boules produced by this technique. (12 Marks)
- 6 a. Discuss the commercially available photoresists of both positive and negative types used in photolithography. (04 Marks)  
b. Illustrate the 'Ion implantation on a substrate' with regard to microsystem fabrication process. (10 Marks)  
c. Discuss the 'plasma assisted etching' –a microsystem fabrication process. (06 Marks)
- 7 a. Illustrate the following terms used in wet etching process :  
Ideal etching, underetching, undercutting. (09 Marks)  
b. Discuss the deep reactive ion etching (DRIE) process. (11 Marks)
- 8 a. Discuss the techniques that can be used to detect faults in measurement, control and data communication systems. (10 Marks)  
b. Illustrate an emulator and simulation used in fault finding in microcontrollers and its programs. (10 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

