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10MAR24

Second Semester M.Tech. Degree Examination, June 2012

Mechatronics System Design

Time: 3 hrs. Max. Marks:100

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

1 a. Explain the functions of basic elements of a measurement system, with an example. **(06 Marks)**

b. Differentiate between open-loop and closed loop control systems. **(06 Marks)**

c. With the help of a block diagram, explain a microprocessor-based system to control the focusing and exposure of an automatic camera. **(08 Marks)**

2 a. How two relays might be used to control the operation of pneumatic valves which in turn control the movement of pistons in three cylinders? List the sequence of operations involved in this control process with a sketch. **(10 Marks)**

b. With a neat sketch, explain the cine film advance mechanism. **(04 Marks)**

c. Explain hydraulic power supply system and its basic elements, with a neat block diagram. **(06 Marks)**

3 a. Fig.Q3(a) shows a thermal system involving two compartments, with one containing a heater. If the temperature of the compartment containing the heater is T_1, the temperature of the other compartment T_2 and the temperature surrounding the compartments T_3, develop equations describing how the temperatures T_1 and T_2 will vary with time. All the walls of the containers have the same resistance and negligible capacity. The two containers have the same capacity C.

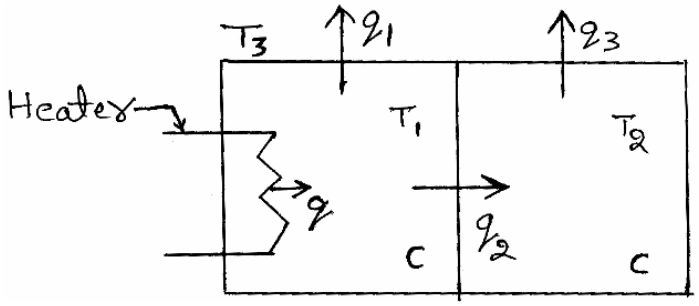

Fig.Q3(a) **(10 Marks)**

b. Explain the following building blocks used in system model representation:
   i) Fluid resistance
   ii) Fluid capacitance
   iii) Pneumatic resistance
   iv) Thermal capacitance. **(10 Marks)**

4 a. Discuss the various applications of Microsystems in the health care industry and aerospace industry. **(12 Marks)**

b. Explain with a neat sketch working of a micro pump. **(08 Marks)**

5 a. List the properties of quartz, gallium arsenide and silicon that makes them as suitable materials for MEMS and Microsystems. **(15 Marks)**

b. List the applications of polymers for MEMS and Microsystems. **(05 Marks)**

6 a. Explain with a sketch, a biomedical sensor for measuring glucose concentration. **(06 Marks)**

b. Explain the process of plasma etching, with a neat sketch. **(06 Marks)**

c. What is photolithography? Explain the steps involved in photolithography, with a sketch. **(08 Marks)**

7 a. Explain the process of surface micromachining. **(10 Marks)**

b. Explain major fabrication steps involved in LIGA process. **(10 Marks)**

8 a. What are the typical faults in microprocessor systems? Explain them. **(06 Marks)**

b. Name different fault-finding techniques and explain logic comparator fault finding technique. **(08 Marks)**

c. Write a note on watch dog timer. **(06 Marks)**

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