Second Semester M.Tech. Degree Examination, June/July 2013

Mechatronics System Design

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions.*

1   a.   Define mechatronics. Explain the multidisciplinary approach in mechatronics.   **(05 Marks)**
    b.   Explain with a block diagram the basic elements of a closed loop system, with an example.
                                                       (10 Marks)
    c.   Explain with a block diagram the engine management system using a microprocessor.
                                                       (05 Marks)

2   a.   Explain how a sequence valve can be used to sequence events in a hydraulic circuit with an example.   **(08 Marks)**
    b.   Explain the following with neat figures:
       i) Rachet and Pawl mechanism   ii) Compound gear trains.   **(08 Marks)**
    c.   Explain how a transistor can be used as a switch with suitable characteristic curves. **(04 Marks)**

3   a.   Derive the relationship between the output, the potential difference a cross the capacitor C, V_C and the input V for the circuit shown in Fig.Q3(a). Use Kirchoff's first law.   **(10 Marks)**
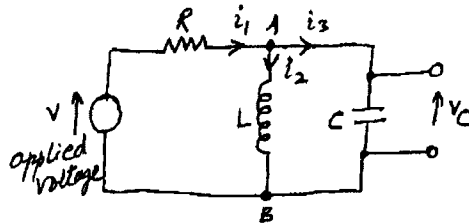

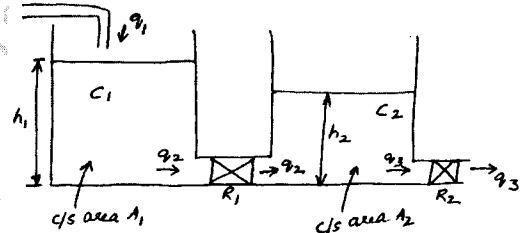Fig.Q3(a)   Fig.Q3(b)

    b.   Obtain the equations describing how the height of the liquid in the containers change with input flow rate for the hydraulic system show in Fig.Q3(b). Assume that the liquid exits into atmosphere.   **(10 Marks)**

4   a.   Give a brief overview of applications of micro systems in the automotive industry. **(10 Marks)**
    b.   Explain the working principle of the following with neat sketches:
       i) Chemical sensors   ii) Micropump   **(10 Marks)**

5   a.   List and explain silicon compounds that are used for MEMS.   **(08 Marks)**
    b.   Illustrate the Czochralski method for growing single crystal silicon.   **(08 Marks)**
    c.   Explain the working of piezoelectric crystal with figure.   **(04 Marks)**

6   a.   What is chemical vapour deposition? Explain the working principle of a CVD using horizontal reactor.   **(10 Marks)**
    b.   What is photolithography? Explain the general procedure for the same with sketches.
                                                       (10 Marks)

7   a.   Explain plasma etching with a neat figure.   **(08 Marks)**
    b.   Explain major fabrication steps involved in LIGA process.   **(08 Marks)**
    c.   Write a note on electroplating.   **(04 Marks)**

8   a.   Explain briefly different techniques used to detect faults.   **(06 Marks)**
    b.   Explain different fault finding techniques used with microprocessor based systems. **(10 Marks)**
    c.   Write a note on watch dog timer.   **(04 Marks)**

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