COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

Mechatronics System Design $\left(MX-501 \right)$

Course: M. Tech

Semester: I

Year: 2014-2015

Duration: 3 Hours   Time:- 2 to 5 p.m

Max. Marks: 60

Date: 2 8 NOV 2014

Instructions: MIS No. ☐☐☐☐☐☐☐☐

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper .
7. **Answers to both sections to be written in separate answer sheets**.
8. All questions are compulsory from section B

SECTION A

Q1. Explain Mechatronics design process with a neat sketch   (5)

Q2. State the pressure range of hydraulic and pneumatic devices. Explain the working a piston type motor.   (5)

Q3. Consider a double acting cylinder subjected to a load. The cylinder is connected to a spool valve the shaft of which is connected to torque motor. Derive an expression for the relationship between the input and output as   (5)

$$\frac{x_2}{x_1} = \frac{A\frac{k_1}{k_2}}{Ms^2 + \left(f + \frac{A^2}{k_2}\right)s}$$

Q4. Explain two pump rapid motion circuit with a neat sketch.   (5)

OR

Explain mechanically operated sequencing circuit.   (5)

Q5. What are the aims of ergonomics? State the various disciplines of ergonomics in mechatronic system design with a suitable example.   (5)

List any 5 level measuring devices. State the principle and working of capacitive probe.

Q6.   **OR**

What are load cells? State their types. Explain the construction of strain gage load cell. Write   (5)
the equation for gage factor

                                                                                            (5)

PART B

Q1. A   Solve the following :   (3)
   1. A resistance wire strain gauge with a gauge factor 2 is bonded to
      a steel structure member subjected to a stress of 100 MN/m2.
      Modulus of elasticity of steel is 200 GN/m2. Calculate the
      percentage change in value of the gauge resistance due to the
      applied stress.
   2. An automatic temperature control arrangement for an electric
      oven is achieved by using thermistor as a temperature transducer.
      A thermistor has a resistance of 2000Ω at 700C. A potentiometer
      is used to obtain balance and set at 1800 Ω. Using linear
      approximation for resistance temperature curve, find out the
      change in temperature of oven. The resistance temperature
      coefficient is -0.05/0C

   B. Design the following mechatronic system(s) with the detailed   (12)
      explanation of the required steps and necessary diagram:
      1. An industrial pH-neutralization system, which continuously monitors
      the pH level of a solution and makes adjustments as needed.
      2. An auto-temperature control System for Greenhouse

Q2. A   What is the significance of optimization in mechatronic system? State   (6)
       and elaborate any two types evolutional optimization methods. Justify
       your answer with the help of typical example.

   B. List down the difference between :   (6)
       1. analytical and numerical models
       2. linear and non linear model
       3. partial and ordinary differential equation

   C. What is the role of neuron network for identification of parameters of   (3)
       mechanical dynamic system? Explain with typical example.