Name : ……………………………………………………..

Roll No. : …………………………………………………

Invigilator's Signature : ……………………………………

CS/M.Tech(AEIE)/SEM-1/EIEM-103C/2011-12

2011

MECHATRONICS

Time Allotted : 3 Hours   *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* of the following.   5 × 14 = 70

1. a) What are the basic elements of mechatronics ?

    b) Describe with a suitable block diagram the disciplinary foundations of mechatronics.

    c) Write down the benefits of semiconductor revolution in mechatronics.   4 + 5 + 5

2. a) What do you understand by active and passive transducer in mechatronic systems ? Give examples.

    b) Write short notes on any *two* of the following :

        i)   Strain gauge

        ii) Ultrasonic sensor

        iii) Capacitive sensor.   (3 + 3) + (4 + 4)

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3. a) What is the role of actuator in mechatronic systems ?

    b) Describe the working principle of hydraulic actuators. What do you mean by single acting and double acting hydraulic cylinders ? What is air muscle ? How does the electromechanical actuator work ?

    c) The bottom diameter and piston diameter of a hydraulic cylinder are 5 mm and 3 mm respectively. The pressure at bottom side is 4 psi while pressure measured at head side of the cylinder is 2·5 psi. Calculate the pulling force.   1 + (4 + 2 + 1 + 3) + 3

4. Discuss about applications of microcomputer in mechatronics. Draw the basic block diagram of a micro-computer. Compare between microcontroller and microprocessor. Define application specific processes (ASICS).   2 + 2 + 5 + 5

5. a) Write in brief the basic differences between amplitude modulation and angle modulation.

    b) An electromechanical actuator is having vibration frequency range 5-50 kHz. Design a suitable circuit that will deactivate the actuator when vibration frequency goes beyond the said range.

    c) State the advantages of FFT compared to DFT.

                                                    5 + 5 + 4

6. Draw the circuit diagram of LVDT. Explain its working principle. What is the residual voltage of LVDT ? Write down the advantages and disadvantages of LVDT. 4 + 4 + 2 + 4

7. a) Describe proximity sensor. Classify them as per the working principle with definition.

   b) Briefly discuss process elements in lumped parameters systems. What is the difference between theoretical and experimental models ?

   c) Compare between sliding bearing and roller bearing. What are the applications of absorbers and dampers in mechanical systems ? (2 + 2) + (2 + 2) + (3 + 3)

8. a) What do you mean by SMA ? Draw the stress-strain curve of SMA and explain its characteristics.

   b) Write short notes on any *three* of the following :

   i) Stepper motor

   ii) Micro actuator

   iii) Industrial robot

   iv) Harmonic oscillator

   v) Servomechanism in robotics manipulation.
   (2 + 3) + (3 × 3)

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