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M. Tech 3rd Semester Examination

Mechatronics Dec 2014

PE-E19

Time : 3 Hours Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any 5 questions. Each question carries equal marks.

1. (a) "Mechatronics brings together the technology of sensors, measurement systems, actuators and engineering design". Explain.

   (b) What are the common sensing technologies that are most widely used for velocity and motion in engineering applications? Explain any one with schematic diagram. **(20)**

2. (a) What do you mean by signal conditioning? Explain different issues which are related with analog signal conditioning.

   (b) State the importance of mathematical models in predicting the behavior of systems. Propose a mathematical model and obtain system differential equations for Chassis of a car as a result of wheel moving along a road. **(20)**

3. (a) Define Sampling and Resolution with reference to analog and digital signals. An 8-bit ADC with a 0V to 10V range is used for the purpose of sampling the voltage of an analog sensor. Determine the digital output code that would correspond to 7.5V.

   (b) Briefly describe the steps and hardware devices used in DAC (digital to analog conversion) **OR** in ADC (analog to digital conversion). **(20)**

4. (a) Explain what logic gates might be used to control following situations? Draw the neat sketches.
   (i) A clock signal as a continuous sequence of pulses is applied to a logic gate and is to be outputted only when enable signal is to be applied to the gate.
   (ii) A safety lock system for operation of a machine tool
   (iii) A boiler shut down switch when temp reaches; say 70°C and circulating pump is off.

   (b) Explain the terminology used in stepper motor specifications. Provide Torque vs Speed characteristics for (i) Stepper (ii) Series (iii) Shunt motors. **(20)**

5. (a) Differentiate between microprocessors and microcontrollers. How they are specified? State their applications.

   (b) Draw the schematic block diagram of minimum configuration of typical microprocessor and explain the blocks. **(20)**

6. (a) Explain different simulation techniques/tools for mechatronic design. Provide an example of how SIMULINK is used with Matlab software to represent and analyze a system.

   (b) List the steps required for data acquisition system for pressure/flow measurement. **(20)**

7. (a) Consider simple requirement for a device which switches on some actuator, e.g. a motor for some prescribed time. Enlist the possible solutions for the problem and Discuss any two with neat sketches.

   (b) Explain the following with ladder program (i) sequencing (ii) master and jump control (iii) timers (iv) counters **(20)**

8. Write short notes on (any two)
   (i) Programmable Logic Controller (PLC) to handle analogue input.
   (ii) Operational amplifier.
   (iii) Light and Temperature sensors. **(10×2=20)**