Mechatronics Comprehensive Exam

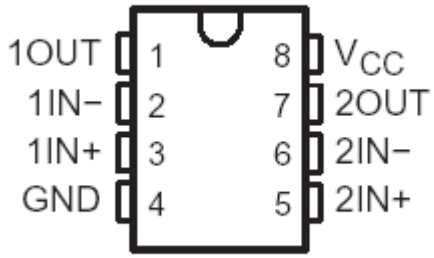
Written Exam Sample

Name:

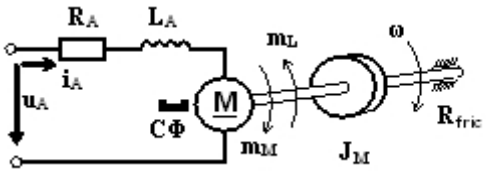
Neptun code:

1. **Prepare a printed circuit of a inverting amplifier, with filter capacitor at input and output. R1 = 10 kOhm, R2 = 100 kOhm, C1 és C2=1 mikroFarad, U_t = 10V. Select LM 358 operational amplifier in DIP-8 package, see layout below. Consider the resistors and capacitors as 2 raster wide (200 mil = 2 x 2,54 mm) THT componets!**

   Prepare the schematic and the PCB draw from the solder side view! Draw the place and pin of the components.



2. The drawing shown below is pictorial representations of real drive that are commonly encountered. (Simple motor drive)



- **Make a freehand sketch of the BOND GRAPH representation of motor drive (use the correct effort and flow description)!**
- **Write the dynamic equations of the elements and junctions of motor drive!**

3. Implement the following logic with LD programming language!

Implement a green house temperature control unit demonstration. Unit should have one ON/OFF switch, temperature and humidity sensor, as digital inputs. The sensor signals should be simulated with push buttons (temperature high and low, humidity high and low). The status of heating, humidifier (on/off state), and the status of temperature and humidity (optimal/not optimal) should be indicated to the operator. When the unit is on, without sensor activity, the temperature and humidity should be optimal, heating and humidifier as off. Case of high temperature signal, heater should be off, and optimal temperature indicator should be out of optimal range. Case of low temperature, the heater should be on, and temperature indicator should be out of optimal range. Case of low humidity, the humidifier should be on and humidity indicator should be out of optimal range. If any of the sensors indicates both low and high, then error signal in on.

4. Implement the following logic with LD programming language!

A pneumatic cylinder is controlled by a 2/2 monostable valve. If the coil is not energized, the P branch is connected with the rod chamber, the cylinder is in exhausted state. Case of valve change the branches are exchanged. The cylinder has two limit switch. The cylinder should be controlled, such when the inner limit switch is active, then the cylinder head should be move forward, and when the outer limit switch is active, then the cylinder head should move backward.

5. Calculate the critical gain of the following equation with Routh Hurwitz stability criteria. Y(s)= 2/((1,1s+2,2)*(2,1s+1,1)*(2,2s2+1s+1))

6. Simplify and realize the following binary equation with relays and OR/NOR logic gates: F4 (D,C,B,A)= Pi(2,3,4,6, x9, x10, 12,14)

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