Sem VII / Mech / CBGS / Mechatronics / NOV-16

20-12-16

QP Code :601400

CBGS

(3 hours) **Total Marks: 80**

NB:

6. **Question No 1 is compulsory**. Attempt any **THREE** questions from remaining.
7. All questions carry equal marks.
8. Answer to each new question should be started on a fresh page.
9. Figure in brackets on the right hand side indicate full marks.
10. Assume suitable data if necessary.

Q1) a Witha block diagram explain a Mechatronics Design process. 4x5=20

b. Explain Inertia matching with a sketch.

c. Explain procedure for selection of actuator.

d. Explain procedure for Cantilever beam vibration control using piezo sensors.

e. Draw properly labeled sketch of a torque development process in three phase motor and explain.

Q2) a) Explain heat dissipation in DC motor and Derive an equation for thermal modeling in DC motor. (10)

b) Explain Piezoelectric drives with neat sketch. State its applications. (10)

Q3) a) Two double acting pneumatic cylinders A, B are selected for an industrial application. The sequence of movement for cylinder is as indicated below -

(AB)+ Delay(5sec) (AB)-

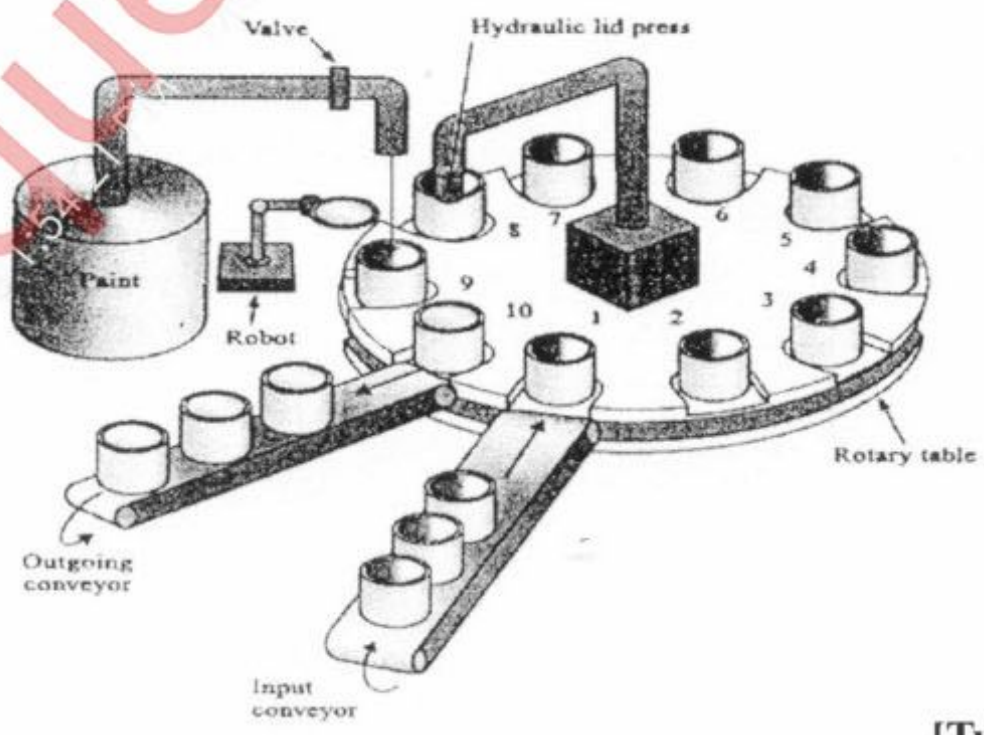
Draw the electropneumatic circuit using 5/2 double solenoid as final directional control valves. (10)

b) Explain with diagram procedure for interfacing motor drive with microcomputer system. (10)

Q4) a) Explain Stepper motor performance characteristics with neat sketch. (10)

b) Explain with a block diagram Multichannel Data Acquisition systems (DAQs). State its benefits. (10)

Q5) a) Write PLC ladder logic diagram as per the operational sequence given below figure. (10)



[Turn Over

An explanation of the operational sequence is as follows:

Step 1: The sequence begins by pressing the start button I:1/1 in rung 0. As output O:2/0 becomes energized, the rung becomes latched and corresponding contacts in rungs 1, 3, 5, 6, and 9 close. The system becomes de-energized by pressing the stop button I:1/0 in rung 0.

Step 2: The closure of the start button also causes rung 1 to latch. By energizing output O:2/1 in rung 1, both conveyor belts begin running. When an empty can from the input conveyor enters the slot in position 1, it activates a limit switch that turns rung 2 True. As the output of rung 2 energizes, it creates a False condition at Examine- Off contact O:2/2, rung 1 unlatches, and the conveyor belts stop. Rung 3 is now in the True condition.

Step 3: When rung 3 becomes True, its output causes a valve to open and paint pours into an empty can at position 9. As the paint fills the can, a strain gauge measures the weight and sends a voltage, which is proportional to the weight of the paint, to an analog-to-digital module in the PLC. The A/D converter module produces a proportional digital value at address I:6.0. This digital value is compared using the EQU instruction on rung 4. Source A of the EQU instruction is the weight of the paint and source B is the program constant of 128.

Step 4: When the paint can fills to 128 ounces, the values at source A and source B of the EQU instruction are the same, which energizes the rung and turns on B3/0. The corresponding Examine-Off (B3/0) on rung 3 becomes False and shuts off the valve. Also, the B3/0 contact on rung 6 energizes the rung, causing a robotic arm to place a lid on the can. When sensor I:1/4 in rung 6 detects the placement of the lid, it causes the rung to latch, starting a motor that rotates the table.

Step 5: As the table and incremental encoder rotate, the up-counter C5:0 in rung 8 increments. After 72 pulses, the accumulator equals the preset value. The DN output of the counter then sets, causing the corresponding Examine-Off contact in rung 6 to become False. The result is that the rung unlatches and the rotary motor stops.

b)Draw a block diagram representing Car engine management system. (10)

Q6) Write Short Note on (ANY FOUR) (20)

3. Accumulator
4. Selection of a PLC system
3 Fire fighting robot.
6 Comb drive
7 Mechatronics systems in factory and business applications