T.E. (SEM.-VI) (CBSGS) (MECHANICAL ENGG.) 03rd June 2015

MECHATRONICS

Q.P. Code : 5002

(CBSGS Course)

(03 Hours) **[Total Marks: 80]**

N.B.:1) Question **No.1** is compulsory.
2) Attempt **any three** questions out of remaining five questions.
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks.

Q.1 Solve any four **(20)**

(a) Define mechatronics and explain factory automation, home and office automation with examples.

(b) Distinguish between pneumatic, hydraulic and electrical actuators with its applications.

(c) Describe the principle of operation of a D.C. motor.

(d) Explain in brief various elements of CNC machine.

(e) What is voice coil actuator ?

(f) Explain Universal Asynchronous Receiver and Transmitter (UART).

Q.2 **(a)** How heat dissipation in DC motor is influenced by velocity profile and coupling ratio. **(8)**

(b) Two double acting hydraulic cylinders A and B are selected for an industrial application. Draw electro electrohydraulic circuit for the sequence of operation (A+B+ delay B- A-) using 4/3 way double solenoid as the final directional control valve. **(12)**

Q.3: **(a)** Describe possible speed control strategies of A.C. Induction motors **(8)**

(b) Discuss on voltage-torque characteristics of D.C. motor. **(8)**

(c) Explain Autonomous Mobile Robot with its applications. **(4)**

Q.4 **(a)** Explain data acquisition system and supervisory control and data acquisition (SCADA). **(08)**

(b) A Process tank shown in Figure 1 is sequenced to mix liquid fertilizer according to following sequence of operation. (12)
(i) A start push button is pressed to start the operation and V_1 is being operated to open in order to fill tank up to a preset level sensed by level switch A. (ii) As the tank fills, a level switch A closes NO contact to energize the stirrer motor to start automatically and operate for 5 sec to mix the fluid. (iii) When stirrer motor stops, the solenoid operated water valve V_2 is energized to empty the tank. (iv) When tank is completely empty, the level switch B opens and de-energizes solenoid operated water valve V_2 (v) A Stop button is pressed to stop operation.

Draw PLC ladder diagram to achieve the above sequence of operation.

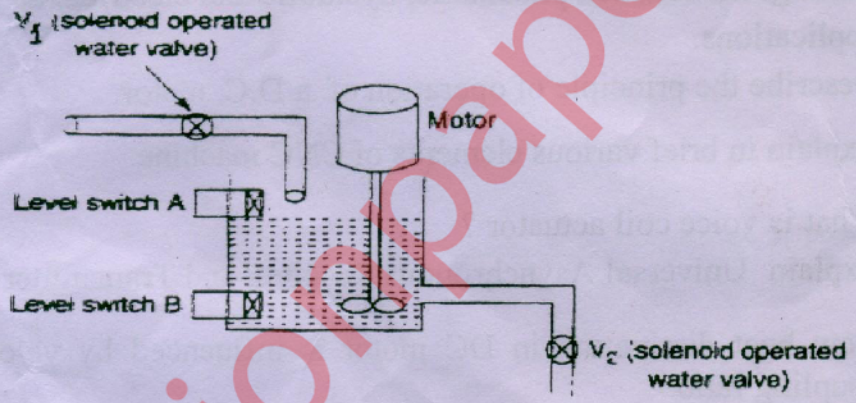

Figure 1

Q.5 (a) What is the difference between parallel and series interface. (4)

(b) How data loggers are used in data acquisition system. (4)

(c) Two double acting cylinders A and B are selected for industrial automation. The motion of sequence A+B+(rapid approach) B+(slow feed) B- A- Draw Pneumatic circuit diagram and step displacement diagram. Select 5/2 way final directional control valves. (12)

Q.6 (a) Explain the basic principle of piezoelectric drives and give its applications. (8)

(b) Explain the working principle of stepper motor and describe its various types along with its applications. (12)
