

Total No. of Questions :10]

SEAT No. :

P2800

[Total No. of Pages :4

[4958] - 1023

T.E. (Mechanical S/W)

MECHATRONICS

(Semester - I) (2012 Course) (End Sem.) (302050)

Time : 2½ Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

Q1) a) List and discuss, in brief, any four criterions for selection of a stepper motor. [6]

b) Reduce the block diagram in Figure 1 and determine the transfer function, X/Y. [4]

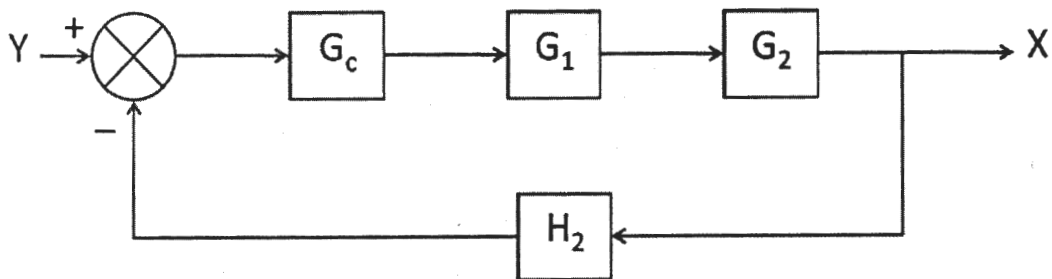


Figure 1

OR

Q2) a) A potentiometer is to be used for measurement of speed of a dc motor. Draw a suitable schematic and explain the working of the said sensor. [6]

b) Write four distinct points of comparison between closed loop control and open loop control. [4]

P.T.O.

- Q3)** a) For a 4 bit ADC with a $V_{ref} = 1$ volts, find the digital equivalent of $V_{in} = 0.6$ volts. [8]
- b) List two assumptions made while deriving a transfer function. [2]

OR

- Q4)** a) Draw a suitable circuit diagram and explain the working of a SHA, Also, list its application. [8]
- b) List any two reasons to justify the need of an OPAMP in a mechatronic system. [2]
- Q5)** a) Explain any five criteria for selection of a Programmable Logic Controller. [10]
- b) A traffic light controller is supposed to execute following sequence of operations. Draw a ladder diagram for implementation of the said sequence. [8]

Step 1: Turn Green ON for 35 seconds,

Step 2: Turn Yellow ON for 5 seconds,

Step 3: Turn Red ON for 40 seconds,

Step 4: Repeat the sequence i.e. Step 1-Step 2-Step 3.

OR

- Q6)** a) Devise a ladder program that can be used with a solenoid valve controlled double-acting cylinder, i.e. a cylinder with a piston which can be moved either way by means of solenoids for each of its two positions, and which moves the piston to the right, holds it there for 2 s and then returns it to the left. [10]
- b) Draw a suitable diagram and discuss the application of SCADA in mechatronics. [8]

- Q7) a)** For the system in Figure 2, derive the transfer function: $y(s)/f(s)$. [10]

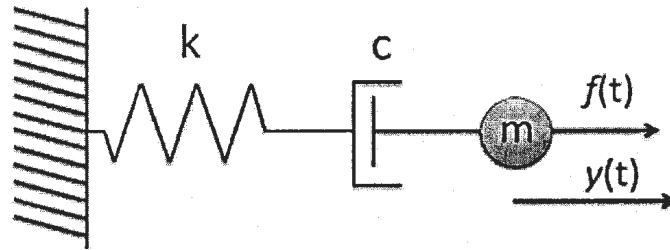


Figure 2

- b) Draw a suitable diagram and explain time domain response. [6]

OR

- Q8) a)** Draw a suitable diagram and explain frequency domain analysis. Also, discuss the advantages and dis-advantages of the frequency domain analysis. [10]

- b) Determine the rise time maximum overshoot and settling time of a second order system subject to a unit-step input. Assume the damping factor = 0.8 and natural frequency = 10 rad/sec. [6]

- Q9) a)** Derive the transfer function of the PID controller in parallel form. Also, discuss the significance of adding the derivative term to the controller. [10]

- b) Discuss the role of transient specifications W.R.T the analysis of performance of the PID controller. [6]

OR

- Q10)a)** Figure 3 shows an error time graph. Sketch the PD controller output w.r.t time. Assume $K_p = 10$, $K_D = 0.5$ and $P_0 = 0$. **[10]**

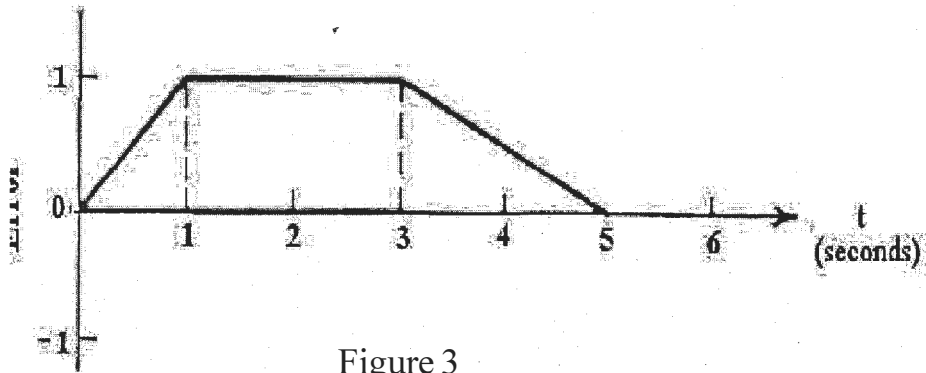


Figure 3

- b) Draw the block diagram of the PID controller in series form and discuss the significance of proportional term in the controller. **[6]**

