sem-VI / mech / 16-12-10 / mechatronics.

P4–Con No–79

Con. 5816–10. (REVISED COURSE) GT–7488

(3 Hours) [Total Marks : 100

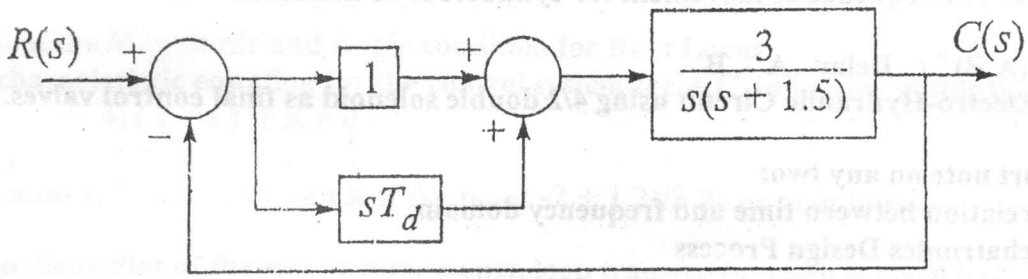
N. B. : (1) Question No. 1 is Compulsory
(2) Attempt any Four questions from the remaining six questions.
(3) Assume suitable data wherever required
(4) Figures to the right indicate full marks

1. (a) Sketch and explain the functional block diagram & architecture of 8051 microcontroller (10)

(b)Obtain the state model of the system described by the Transfer function (5)

$$\frac{Y(s)}{U(s)} = \frac{5}{S^3 + 6S + 5}$$

(c) Fig1 below shows a PD controller used for controlling system performance. Determine T_d to make system critically damped. Calculate settling time. (5)



2. (a) For a continuous cycle Electro-pneumatic system with two linear actuators having following sequence (12)

A^+, B^+, Delay , $(A\ B)^-$

Draw the step displacement diagram & Draw the circuit.

(b)Draw the flow chart and write assembly level program for addition of two numbers (8)

#0F8h and #9Ch. Store the sum in 20h and carry in 21h. What will be the result in 20h and 21h?

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3. (a) For the transfer function given, find the following (6)

$$G(s) = \frac{5(S+2)}{S^2(S+1)(S+5)}$$

(i) Type of system (ii) Error constants
(ii) Steady state error for input $1 + 5t + (t^2/2)$

(b) Explain Interfacing of stepper motor with 8051 microcontroller (10)

(c) What are the factors to be considered for selecting a PLC for control system application? (4)

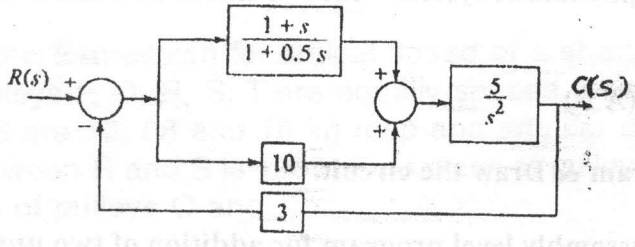
4. (a) Two double acting hydraulic cylinders A , B are selected for an industrial application. The sequence of movement for cylinders is as indicated below: (10)

$(A\ B)^+$ / Delay A^-, B^-

Draw the Electro-Hydraulic Circuit using 4/2 double solenoid as final control valves.

(b) Write short note on any two: (10)
(i) Correlation between time and frequency domain.
(ii) Mechatronics Design Process
(iii) Servo motor

5. (a) Convert the system given below into a unity feedback system: (6)



(b) Compare: Routh's criteria and Hurwitz criteria for stability (10)
For a unity feedback control system:

$$G(s) = \frac{k}{s(s+0.4s)(1+0.25s))}$$

Using Routh's criteria, find the range of values of K for a stable system. Find marginal value of K and the frequency of sustained oscillations.

(c)Obtain mathematical model of thermometer. (4)

6. (a) Design and draw pneumatic circuit for the following operation sequence. Include circuit for single cycle ,multi cycle and emergency operation. (12)

A⁻ , B+ , delay , A+ , B-

You can develop the circuit using Cascade or Shift Register method.

(b) A unity feedback control system has an open loop transfer function (8)

$$G(s) = \frac{5}{S(S+1)}$$

Find the rise time, percentage overshoot, peak time and settling time for

a step input of 10 units. Also determine the peak overshoot.

7. (a) Explain the Magnitude and Angle condition for Root Locus. (10)
The characteristic equation for the control system for A.C. induction motor is $(s+2)(s+4)(s+a) + K = 0$.

Determine the value of a and K if the point $-2 + j\,2\sqrt{3}$ lie on root locus.

(b) Draw Bode Plot of the system whose open loop transfer function is given by: (10)

$$G(s)\,H(s) = \frac{100(S+3)}{S(S+1)(S+5)}$$

Determine Gain Margin & Phase Margin and comment on stability of the system.
