

QP Code : 1998

(OLD COURSE)

(03 Hours)

[Total Marks: 100]

N.B.:1) Question No.1 is compulsory.

2) Attempt any four questions out of remaining six questions.

3) Assume suitable data if necessary.

4) Figures to the right indicate full marks.

Q.1 (a) Explain the mechatronics design process with a neat sketch. (05)

(b) Examine the stability of the following characteristics equation (10)

i) $s^4 + 10s^3 + 35s^2 + 50s + 24 = 0$

ii) $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15 = 0$

(c) What is proportional-integral-differential (PID) controller? Explain role of each of the constituents with neat sketch. (05)

Q.2 (a) Draw and explain in brief functional block diagram (architecture For 8051 microcontroller) (05)

(b) For a unity feedback system (08)

$$G(s) = \frac{36}{s(s + 0.72)}$$

Determine characteristic equation and hence calculate damping ratio, Peak time, settling time, peak overshoot and number of cycles completed before output settles for a unit step input.

(c) Draw programmable ladder logic diagram for the following sequence of motion of double acting cylinder A (select appropriate final directional control valve): A+ Delay A- (07)

Q.3: (a) Draw Pneumatic circuit for the industrial application defined by the sequence A+ Delay B+ A-B- with Single and Multicycle option. A and B are pneumatic double acting cylinders. (12)

(b) For unity feedback system having (08)

$$G(s) = \frac{10(s + 1)}{s^2(s + 2)(s + 10)}$$

Determine : i) Type of system ii) Error coefficients and iii) Steady state error for inputs as

$$1 + 4t + \frac{t^2}{2}$$

[P T O]

QP-Con. 10300-15.

(2)

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- Q.4 (a) Draw the root-locus of the control system whose open-loop transfer function is given by (10)

$$G(S)H(S) = \frac{K(S+2)}{S(S+5)(S+8)}$$

- (b) A system has $G(s)H(s) = \frac{K}{s(1+s)(1+0.1s)(1+0.01s)}$, Draw Bode plot and find value of K. (10)
to get Phase Margin = +25° and Gain Margin = +10dB

- Q.5 (a) Using block diagram reduction technique, determine the net response of the system (10) shown in Figure 1

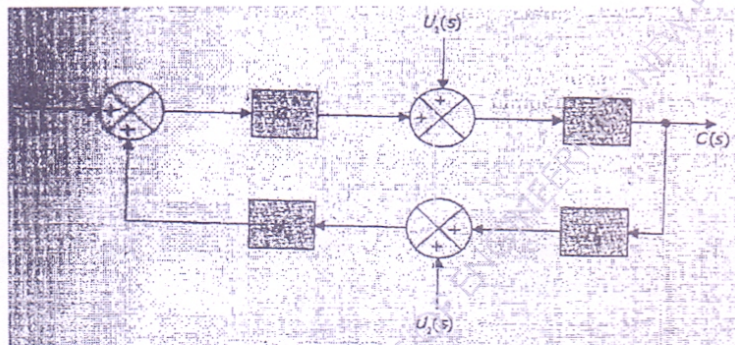


Figure 1

- (b) Two double acting cylinders A and B are selected for an industrial application. Draw (10)
electropneumatic circuit for the sequence of operation as A+B+ delay (AB)- using 4/3
way double solenoid as the final directional control valve.

- Q.6 (a) Explain the functions of ports 0, 1, 2, and 3 in 8051 microcontroller (10)

- (b) Consider the system described by (10)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -4 & -1 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Obtain the transfer function of the system.

- Q.7 Explain the following (20)

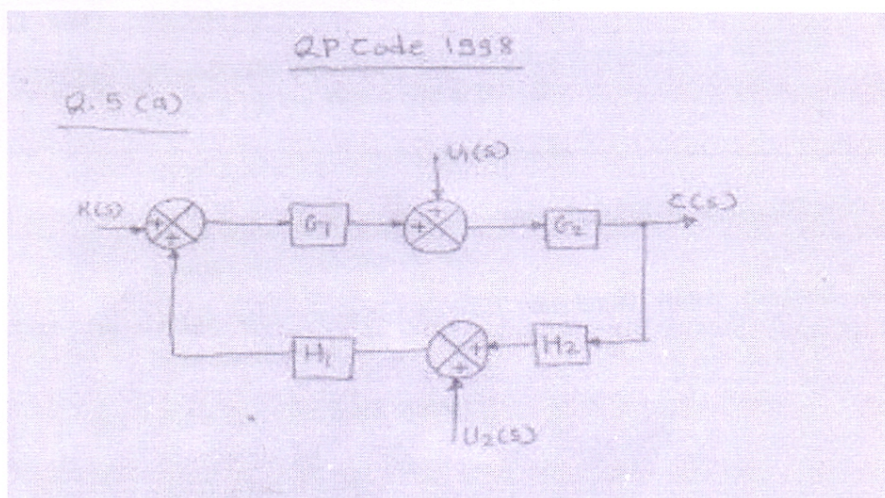
- i) Servomechanism
- ii) ON/OFF controller
- iii) Effect of damping ratio on Response of the system
- iv) Stepper motor

Course: T.E. (SEM.-VI) (OLD) (MECH ENGG) CW (AUTO ENGG) (PROG-T3516 CW T2216)

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Correction:

PFA correction in QP Code 1998.



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