Total No. of Questions :10]

SEAT No. :

P3775

[Total No. of Pages : 2

[5059]-696
B.E. (Instrumentation)
ADVANCED CONTROL SYSTEM
(2012 Course) (Semester-I) (Elective-I)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate, full marks.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic***
5) ***Pocket calculator and steam tables is allowed***
6) ***Assume suitable data, if necessary.***

Q1) What is describing function? State steps to find describing function. Find same for backlash. **[10]**

OR

Q2) What is phase plane plot? How stability of system can be obtain form phase plane plot. **[10]**

Q3) The second order system is given by. **[10]**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 3 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Check whether system is asymptotically stable or not and find the Lyapunov function $v(x) = x^T Px$

OR

Q4) A NL system has $G(s) = \dfrac{30}{s(1+0.3s)}$ as a linear part and $N(x,jw) = \dfrac{1}{x}\angle -75^o$ **[10]**

as the describing function for it's NL part where x is sinusoidal input to the NL element, find the amplitude and frequency of the possible periodic solution.

Q5) a) Explain parameter estimation method in self tuning regulator. **[8]**

b) Explain implicit self tuning regulator. **[8]**

OR

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Q6) a) Explain self tuning regulator. **[8]**

b) Fit the second order polynomial using least square method for following data. **[8]**

i	1	2	3	4	5	6
X	0	0.5	1.0	1.5	2.0	2.5
Y	0	0.25	1.0	2.25	4.0	6.25

Q7) a) Explain application of adaptive control pulp digester. **[9]**

b) Explain first loop adaptive controller. **[9]**

OR

Q8) a) Explain application of adaptive control to rolling mill. **[9]**

b) Explain Fisher control DPR 900. **[9]**

Q9) Consider the system. **[16]**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 2 \\ 4 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Determine the optimal feedback control gain matrix K such that the following performance index is minimized.

$$\mathrm{j} = \int_0^\infty \left(x^T Q x + u^2 \right) dt$$

Also draw the block diagram of resulting optimal control system.

OR

Q10)a) Explain infinite time regulator. **[8]**

b) Explain model matching based on linear quadratic optimal regulator. **[8]**

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