Total No. of Questions : 10]

SEAT No. :

P4551

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[4959]-1196

B.E. (Instrumentation & Control Engineering)
ADVANCED CONTROL SYSTEMS
(2012 Pattern) (Semester - I) (Elective - I (C))

Time : 2.30 Hours] ***[Maximum Marks : 70***

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Assume suitable data, if necessary.***
3) ***Figures to the right indicate full marks.***

Q1) a) Explain in brief the concept of phase plane method. **[3]**

b) Define describing function: obtain the describing function for saturation Nonlinearity. **[7]**

OR

Q2) a) Explain in brief the concepts of singular points. **[3]**

b) A second order system represented by $\dot{x}$=Ax where $A = \begin{bmatrix} -1 & -2 \\ 1 & -4 \end{bmatrix}$ by using Liapunov's direct method, determine the stability of the system. **[7]**

Q3) a) Explain in brief of Frequency domain stability criteria. **[4]**

b) Explain with neat diagram of MIT rule for continues time MRAC system **[6]**

OR

Q4) a) Explain in brief the concepts of stability. **[4]**

b) Explain with neat diagram of different configurations of MRAC. **[6]**

Q5) a) Explain in detail LQG self-tuning regulator. **[6]**

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b) In the self-tuning regulator following input output data has been obtained from the real plant. **[10]**

Time(t)	Input data u(t)	Output data y(t)
1	2.0	0.1
2	3.0	4.0
3	2.0	-2.0
4	1.5	4.0
5	1.0	2.0

Use any regression to fit a model with the structure y(t)+ay(t-1) = bu (t-1)+e(t) where e(t) = error signal.

OR

Q6) a) Explain in detail different approaches to self - tuning regulator. **[8]**

b) Explain minimum variance and pole assignment approaches to multivariable self tuning regulators. **[8]**

Q7) a) Explain in detail robustness studies of multivariable system. **[8]**

b) Explain adaptive control technique for control of rolling mill. **[8]**

OR

Q8) a) Explain in detail the General-purpose adaptive regulator. **[8]**

b) Explain in detail adaptive control technique for temperature control in CSTR system. **[8]**

Q9) a) Explain the necessary conditions of optimal control problem. **[6]**

b) Obtain the control law that minimize the performance index **[12]**

$$J = \int_0^\infty \left(x_1^2 + u^2\right) dt$$

For the system given below: $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$

OR

Q10) a) Explain in detail matrix ricacati equations **[6]**

b) The first order system is described by the differential equation **[12]**

$$\dot{x}(t) = 3x(t) + u(t)$$

It is desired to find the control law that minimizes the performance index

$$J = \frac{1}{2}\int_0^{t_f}\left(3x^2 + \frac{1}{4}u^2\right)dt, \qquad t_f = 1 \text{ sec}$$

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