Total No. of Questions :12]

SEAT No. :

P819

[Total No. of Pages :4

[4659] - 67
B. E (Electrical)
CONTROL SYSTEM-II
(2008 Pattern) (Sem.-I)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) *Answer Three questions from Section I and Three questions from Section II.*
2) *Answers to the two sections should be written in separate books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Black figures to the right indicate full marks.*
5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

SECTION-I

Q1) a) Explain with neat block diagram following types of compensation. **[9]**

i) Series compensation

ii) Feed back compensation

iii) Load compensation

b) Design a log compensating network for **[9]**

$$G(S) = \frac{K}{S(S+2)(S+20)}$$

with given specifications

$Kv = 20\ sec^{-1}$ P.M $>_1 35^o$

Take margin of safty for PM 5^o

OR

P.T.O.

Q2) a) Explain design procedure for phase lead compensation and it's effect on overall performance of the system. Also give limitations of phase lead compensation. **[9]**

b) The open loop transfer function of a unity feed back is $G(S)=\dfrac{5K}{S(S+5)}$

It is required that Kv=20 and PM=44° Design compensating network if system does not satisfy the required specification.Take margin of safty for PM 4° **[9]**

Q3) a) Explain the concept of diagonalization and discuss how this is achieved **[8]**

b) The system equations are given by matrices

$$A=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\quad B=\begin{bmatrix}0\\1\end{bmatrix}\quad C=\begin{bmatrix}1 & 0\end{bmatrix}$$ **[8]**

Find transfer function of the system

OR

Q4) a) Derive solution of nonhomogeneous state equation. **[8]**

b) Compute the STM when $A=\begin{bmatrix}-1 & 1\\ 0 & -2\end{bmatrix}$ **[8]**

Q5) a) Define controllability and observability of the system. Also explain controllability and observability matrices by Kalman's test **[8]**

b) The closed loop poles are tobe located at $S=-2, S=-1$ Design state variable feed back when given that **[8]**

$$A=\begin{bmatrix}0 & 1\\ -2 & -1\end{bmatrix}\quad B=\begin{bmatrix}0\\1\end{bmatrix}\quad C=\begin{bmatrix}1 & 0\end{bmatrix}$$

OR

Q6) a) Explain pole placement design by state feed back. **[8]**

b) Consider the following system.

$$X = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U(+)$$ **[8]**

$$Y(+) = [0\ 1] \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$

Test controllability and observability of the system.

SECTION-II

Q7) a) Explain design specifications in Time domain and Frequency domain. **[8]**

b) Derive an expression of k_d and Kp to design Cascade PID controller in Frequency domain. **[8]**

OR

Q8) a) Explain P,PI and PID control mode with their characteristics. **[8]**

b) Consider a unity feedback system with open loop transfer function,

$G(S) = \dfrac{5}{S(S+0.5)\ (S+1)}$ Design a PD controller so that the phase margin of system is 30^o at frequency of 1.2 rad/sec. **[8]**

Q9) a) Give comparision between linear and non-linear control system. **[8]**

b) With proper diagrams derive describing function of relay with dead zone. Also state clearly the assumptions made. **[8]**

OR

Q10) a) Discuss the pecularities of non-linear systems which can not be explained on the basis of linear theory. **[8]**

b) In a unity feedback system on ideal relay with out put ± 1 unit is connected in cascade with $G(S) = \dfrac{50}{S(S+1)(S+2)}$ Determine amplitude and frequency of limit cycle if it exists. **[8]**

Q11) a) Discuss the different types of singular points that occur in the phase plane trajectories. **[9]**

b) Explain the procedure to draw phase plant trajectories by Delta Method. **[9]**

OR

Q12) a) Explain terms: **[6]**

i) Stability

ii) Asymptotic Stability and

iii) Instability

b) Describe Krosovskil Method of Constructing Lyapunov function for non linear systems. **[6]**

c) Using sylverster's Criterion, show that following quadratic form is positive definite. **[6]**

$$V(x) = 8X_1^2 + X_2^2 + 4X_3^2 + 2X_1X_2 - 4X_1X_3 - 2X_2X_3$$

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