Exam.Code:0935
Sub. Code: 6985

1078
B.E. (Electrical and Electronics Engineering)
Fifth Semester
EE-509: Control Engineering

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.*

x-x-x

Q.1.

i) What are the performance criteria specified for compensators?

ii) What is the effect of PD controller on steady state error?

iii) What are the advantages of state space model over that of a transfer function model?

iv) What is the Z-transform of unit ramp function?

v) How do we assess the stability of non-linear control system?

(5X2=10)

PART-A

Q. 2 (a) A continuous time system has the state variable description as given below.

$A = \begin{vmatrix} 2 & -1 \\ 1 & 0 \end{vmatrix}$; $B = \begin{vmatrix} 1 \\ 0 \end{vmatrix}$; $C = [3 \quad 1]$; D=[2]. Determine the transfer function. (5)

(b) For the given system determine the observability of the system. $\dot{x} = \begin{vmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{vmatrix} x + \begin{vmatrix} 0 \\ 0 \\ 1 \end{vmatrix} u$

$y = [3 \quad 4 \quad 1]x$ (5)

Q. 3 (a) The forward path transfer function of a unity feedback control system is given by $G(s) = \frac{20}{(s+3)(s+5)}$. Design a PI controller to have a phase margin of 65° at a frequency ω=6 rad/sec. **(5)**

(b) Why tuning of PID controller gain parameters is important? Explain Kuhn-Kohn method as used for parameter tuning. **(5)**

Q-4. Explain the step by step procedure to lag-lead compensator. Hence design this compensator for a feedback unity control system having open loop transfer function as $G(s) = \frac{K}{s(s+2)(s+20)}$. The specifications of the compensator should be as follows:

i) Static velocity error=0.1
ii) $PM\ \Phi \geq 50^o$
iii) $Gain\ Margin\ G_m \geq 10\ dB$ **(10)**

P.T.O.

PART-B

Q 5. How can stability analysis be done using describing function method. Hence discuss Popov's stability criterion in detail. **(10)**

Q.6 (a) Discuss advantages of sampled data control system over analog control system. State some applications of sampled data control systems. **(5)**

(b) Convert the continuous transfer function $T(s) = \frac{1}{s^2+2s+2}$ to discrete transfer function with sample time of 1 sec. **(5)**

Q.7. (a) Explain the working of a stepper motor and design the system to operate it in a controlled way with neat block diagram. **(5)**

(b) What is sampling process and hence explain the process this signal is reconstructed. **(5)**

x-x-x