Exam.Code:0930
Sub. Code: 6920

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1059

B.E. (Electronics and Communication Engineering)

Sixth Semester

EC-624: Control System

Time allowed: 3 Hours | Max. Marks: 50

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

X-X-X

I Short answer type questions. (01x10)

a. What are the standard test signals used in time domain analysis?

b. What are the frequency domain specifications?

c. Write any two properties of eigenvalues.

d. What are linear and nonlinear systems?

e. What is the necessary and sufficient condition for stability?

f. Mention the need for state observer?

g. What is zero state response?

h. Mention the advantages of state space modeling using physical variable?

i.Define complete observability.

j.What is signal flow graph?

Section –A

II a) Write the dynamic equation in respect of the mechanical system given in Fig.1. Also obtain equivalent electrical network using force-voltage analogy. (05, 05)

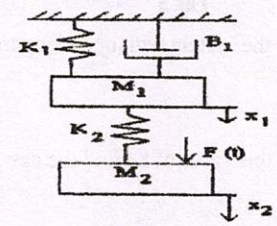

Fig 1

b) Determine the transfer function C(S)/R(S) for the block diagram shown in Fig.2.

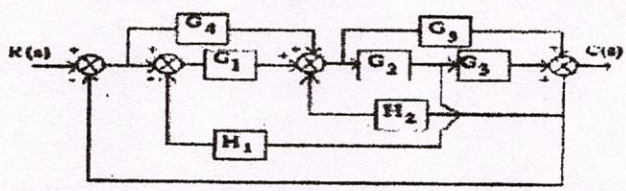

Fig. 2

III a) Explain the differences between open loop and closed loop control system and write the effects of Feedback in control systems (05, 05)

b) What is steady state error? Discussstatic error coefficients.

IV a) Derive the expressions for rise time, peak over shoot, settling time of Secondorder system(05, 05)of unit step input.

b) Determine the stability of a control system by Routh criterion with the following given open-loop transfer function.

$$G(s)H(s) = \frac{K(s+2)}{s(s+3)(s^2+2s+3)}$$

P.T.O.

Section- B

V a) Sketch the Bode plot for the open loop transfer function $G(s) = \frac{10(s+3)}{s(s+2)(s^2+4s+100)}$ (05, 05)

b) Sketch the root locus diagram for a unity feedback system with its open loop function as $G(s) = \frac{K(s+3)}{s(s^2+2s+2)(s+5)(s+9)}$. Find the value of K at a point where the complex poles provide a damping factor of 0.5.

VI a) For the given open loop transfer function $G(s) = \frac{K}{s(s+4)(s+6)}$; Design a suitable lead (05,05)

Compensation so that phase margin is $\geq 30^\circ$ and velocity error constant $K_v \geq 15$.

b) Determine the following: i) State transition matrix ii) Controllability and observability for the state equation of a linear time-invariant system given in Fig.3.

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} -2 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Fig. 3

VII Determine the value of the gain constant K for the system with open loop transfer function

$$G(s) = \frac{K}{s(1+0.2s)(1+0.01s)};$$

so that it has a phase margin of about 35° for this value of K, find the new gain margin. (10)

x-x-x