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BTS(C) – VI – 11 – 013 – P

B. Tech Degree VI Semester Examination April 2011

EE 603 CONTROL SYSTEMS I

(*2006 Scheme*)

Time : 3 Hours Maximum Marks : 100

PART – A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) State and explain Nyquist's stability criteria.

(b) For a certain system, gain margin is found to be zero. What is the phase margin? What is the implication with regard to the stability of the system?

(c) Mention the significance of break away and break in points in the root locus plots.

(d) Explain the structure and characteristics of two phase ac servomotor.

(e) Mention the significance of compensation in the design of a control system. Differentiate between cascade and feed back compensation.

(f) Distinguish between Proportional, Derivative and Integral controllers.

(g) State and verify the principle of duality as applied to continuous time systems.

(h) Enumerate the properties of state transition matrix.

PART – B

(4 x 15 = 60)

II. Sketch the Bode plot for the Transfer function given below

$G(s)H(s) = \dfrac{2(s+0.25)}{s^2(s+1)(s+0.5)}$. Also determine

(i) The phase cross over frequency and the gain cross over frequency

(ii) The gain and phase margins. (15)

OR

III. What is meant by relative stability? Using Nyquist plot, discuss the stability of the control system described by the following transfer function.

$G(s)H(s) = \dfrac{K(s+5)}{s(s+200)}$. (15)

IV. Draw the root locus plot for the system represented by the transfer function $G(s) = \dfrac{\alpha}{s(s^2+6s+10)}$, as the parameter α varies from zero to infinity and hence determine the value of α so that the damping ratio of the dominant pole is 0.6. (15)

OR

V. Explain the working of a stepper motor and its use in a digital control system. (15)

(P.T.O)

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VI. Design a cascade compensation for the following system

$$G(s) = \frac{K}{s(1+0.1s)(1+0.001s)}$$

to satisfy the following specifications. Phase margin ≥ 45 degree, velocity error constant = 1000/sec. (15)

OR

VII. (a) Obtain the transfer function and hence the pole zero plot of a lag-lead compensator network. (6)

(b) What is meant by tuning of a PID controller? Discuss within the context of a process control system. (9)

VIII. Check the controllability and observability of the system described by

$$\begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} [u]$$

$$y = \begin{bmatrix} 4 & 5 & 1 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix}.$$

(15)

OR

IX. Define a state observer. Distinguish between full order and reduced order observer. (15)

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