TEC-501   1011

Odd Semester Examination 2018-19

B.TECH. (ECE) (SEMESTER-V)

# AUTOMATIC CONTROL SYSTEMS

Time: 03:00 Hours   Max Marks : 100

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

1.   Attempt any four of the following questions :   [5x4=20]

   (a)   Define analogous system. Discuss force voltage analogy.

   (b)   What is feedback? Explain effects of feedback.

   (c)   Find the transfer function of the system shown in figure.
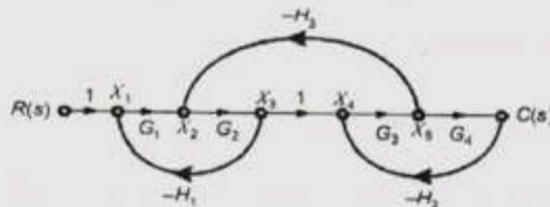
   (d)   Express the effect of pole zero cancellation on polar plot.

   (e)   Explain response of the first order system with unit ramp function.

2.   Attempt any four of the following questions :   [5x4=20]

   (a)   Explain application of control system to engineering fields with examples.

   (b)   Verify and comment on the stability of following system $S^4+2S^3+3S^2+4S+5 = 0$

   (c)   Determine the error coefficient for the following system

TEC-501/940   (1)   [P.T.O.]

$$G(S)H(S) = \frac{(S+2)}{S(1+.5S)(1+.2S)}$$

(d) Discuss the working of hydraulic proportional controller.

(e) Derive the expression for rise time and maximum overshoot for II order system subjected to unit step input.

3. Attempt any two of the following questions : [2x10=20]

(a) For the system $F(S) = S^4 + 22S^3 + 10S^2 + S + K$ Obtain the marginal values of frequency of oscillation and the value of K.

(b) Explain PI, PD and PID controllers with their applications and error constant.

(c) Draw the bode plot for the unity feedback transfer function given below

$$G(S)H(S) = \frac{K(1+S)}{S(1+.1S)(1+.4S)}$$

Calculate

(i) The value of K for a gain margin of 22dB

(ii) The value of K for a phase margin of 45^0.

4. Attempt any two of the following questions : [2x10=20]

(a) Explain the Nyquist stability criterion. Sketch the Nyquist plot and determine the stability of unity feedback system $G(s) = K/S^2(1+ST)$

(b) What is lag-lead compensator? Obtain the transfer function and draw the bode plot and pole zero plot for lag lead compensator.

(c) Obtain a state space model for the following system

$$G(S) = \frac{20(10S+1)}{(S^3 + 3S^2 + 2S + 1)}.$$

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5. Attempt any two of the following questions :   [2x10=20]

(a) What is robust control system? Explain its sensitivities and stability test in detail.

(b) What is controllability and observability ? State whether the following system is controllable or not

$$x_1' = -x_1 + u$$

$$x_2' = x_1 - 2x_2 + u$$

(c) Write short notes on following

(i) Lyapunov function.

(ii) Different types of non linearities.

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