GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

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Total Number of Pages : 3 B.TECH

4th Semester Regular Examination-April-May 2019

BEEPC4020 – CONTROL SYSTEMS-I

(Regulations 2017) Common to AEIE / ECE,EE,EEE Branch

Time : 3 Hours Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) 10 x 2=20 Mark

Q.1. Answer *All* Questions.

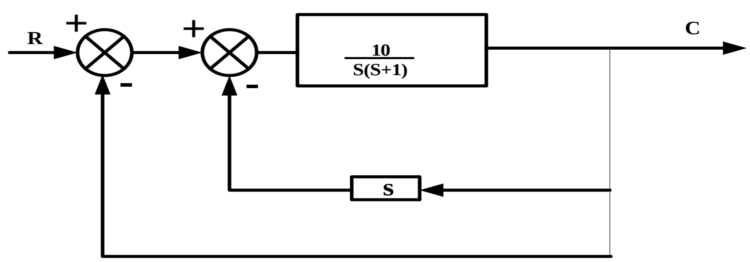
a A position control system is a/an [CO1] [PO1]

a. Automatic regulating system b) Process control system c) Servo mechanism
d. Stochastic control system

b A temperature control system is known as: [CO1] [PO1]

a. Process control system b. Servo mechanism c. Cascade control system
d. Automatic regulating system

c For the system shown below, the transfer function C(s)/R(s) is equal to [CO1] [PO2]



a. $\frac{10}{s^2+s+10}$ b. $\frac{10}{s^2+11s+10}$ c. $\frac{10}{s^2+9s+10}$ d. $\frac{10}{s^2+2s+10}$

d The transfer function of a system is 10/(1+s). The steady state error to unit step input when operated as a unit feedback system is: [CO2] [PO1]

a. 10 b.0 c. 1/11 d. ∞

e For a second order system as ζ increased from zero, the response becomes [CO3] [PO1]

a. progressively more oscillatory b. progressively less oscillatory c. zero d.infinity

f It is given that G(s)= $\frac{k}{s^2(1+sT)}$. This system is operated in closed loop with unity feedback. What is the order and type of the closed loop system? [CO3] [PO2]

a. 3 and 2 b.2 and 3 c. 3 and 1 d. 3 and 0

g G(s)= $\frac{1+s}{s(1+0.5s)}$. The corner frequencies are [CO2] [PO2]

a. 0 and 1 b. 0 and 2 c. 0 and -1 d. 1 and 2

h The polar plot of a closed loop system with a transfer function $\frac{G}{1+GH}$ is drawn for [CO2] [PO1]

a. G b. 1+GH c. GH d. $\frac{G}{1+GH}$

i If the gain of the open loop system is doubled, the gain margin [CO2] [PO1]

a. is not affected b.gets doubled c. becomes half d.becomes one-fourth

j If stability error for step input and speed of response be the criteria for design, what controller would you recommend? [CO4] [PO1]

a. P controller b. PD controller c.PI controller d.PID controller

PART – B: (Short Answer Questions) 2x10=20 Marks

Q.2. Answer *ALL* questions

a	What is the function of a tachogenerator? Write down the transfer function of a tachogenerator?	[CO1] [PO1]
b	What are the effects of negative feedback control on sensitivity to noise and parameter variation of a system?	[CO1] [PO1]
c	Write the Mason's gain formula for a signal flow graph and state the various terms in it.	[CO1] [PO1]
d	Draw the signal flow graph for a given Transfer function: $T(s)= 4/s^2+6s+11$	[CO1] [PO2]
e	When a second order control system is subjected to a unit step input, the values of $\zeta=0.5$ and $\omega_n=6$ rad/s. Determine the rise time and peak time.	[CO2] [PO1]
f	In root locus technique, what is the difference between the breakaway point and asymptotic point.	[CO3] [PO1]
g	Define Nyquist Contour.	[CO2] [PO1]
h	Briefly explain gain margin & phase margin.	[CO2] [PO1]
i	Differentiate between constant M-circles and N-circles.	[CO2] [PO1]
j	What are the effects of integral control action?	[CO4] [PO1]

PART – C: (Long Answer Questions) 15x4=60 Marks

Q.3 Answer *ALL* questions

a. For the system represented by the following equations, find the transfer function X(s)/U(s) by using Mason's gain formula and verify the result using block diagram reduction technique. [CO1] [PO2]

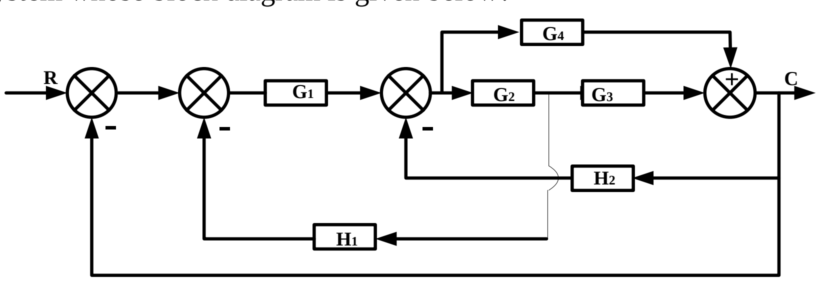
$$x = x_1 + Au$$
$$\dot{x}_1 = -A_1x_1 + x_2 + B_1u$$
$$\dot{x}_2 = -A_2x_1 + B_2u$$

10 Marks

b. Explain the construction and working of a synchro. 5 Marks [CO1] [PO1]

OR

c. Using block diagram reduction techniques, find the closed loop transfer function of the system whose block diagram is given below? [CO1] [PO2]



10 Marks

d. Explain the working principle of A.C Servomotor used for low power application. 5 Marks [CO1] [PO1]

Q.4

a. Discuss the time response of a second order control system by clearing defining the terms a) Rise time b) Maximum overshoot and Peak time c) Settling time. Draw a neat diagram to explain these terms. 10 Marks [CO2] [PO1]

b. A unity negative feedback control system has an open loop tranfer function consisting of two poles, two zeros and a variable gain K. The zeros are located at -2 and -1; and the poles are at 0.1 and +1. Using Routh's stability criterion, determine the range of values of K, for which the closed loop system has 0,1 or 2 poles in the right half s-plane. 5 Marks [CO2] [PO2]

OR

c. What is steady state error of a control system? Define and explain various steady state error coefficients. Discuss about the various steady state error coefficients for type-0 system. 10 Marks [CO2] [PO1]

d. A unity feedback position control system has a forward path transfer function G(s)= K/s. for unit step input, compute the value of K that minimizes ISE. 5 Marks [CO2] [PO1]

Q.5

a. Explain the correlation between time and frequency Response 5 Marks [CO3] [PO1]

b. A feedback control system has forward path gain G(s)=4/s(s-1) and feedback path gain H(s)= (s+1). Draw the Nyquist diagram for the system and assess the stability of the closed loop system. 10 Marks [CO3] [PO2]

OR

c. Write a short note on constant M-Circles a for unity feedback system. 5 Marks [CO3] [PO1]

d. Draw the log-magnitude asymptotic plot for the transfer function, G(s)= 2000s/(s+10)(s+100). And find (a) the gain crossover frequencies, and (b) the frequencies at 3-dB attenuation. 10 Marks [CO3] [PO2]

Q.6

a. Construct a state model for the system described by the transfer function [CO4] [PO2]

$$\frac{Y(s)}{U(s)} = \frac{s^2 + 3s + 4}{s^3 + 2s^2 + 3s + 2}$$

10 Marks

b. Test the observability of the system described by [CO4] [PO2]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \qquad y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

5 Marks

OR

c. Derive the effect of PD control on damping ratio, peak overshoot, steady state error and rise time of a second order unity feedback system. 10 Marks [CO4] [PO1]

d. State the Ziegler-Nichols rules for controller tuning. 5 Marks [CO4] [PO1]

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