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Code No: 115AD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2016
CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) What type of feedback is employed in control system? [2]
b) What are the basic elements used for modelling mechanical rotational system? [3]
c) Give the advantages of transfer function. [2]
d) Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system. [3]
e) What is the difference between type and order of a system? [2]
f) What is steady state response? [3]
g) Define stability. [2]
h) What is Routh stability criterion? [3]
i) Define Phase cross over. [2]
j) Write short notes on the correlation between the time and frequency response. [3]

PART - B

(50 Marks)

2.a) When is a control system said to be robust? Explain with suitable example.
b) Describe the open loop and closed loop control system. [5+5]

OR

3.a) Find the impulse response of the system described $G(s) = \frac{2}{s^2 + 2s + 6}$, $H(s) = \frac{1}{s+2}$.
b) List the advantages and disadvantages of feedback systems. [5+5]

4. Describe a two phase a.c. servomotor and derive its transfer function. [10]

OR

5. A servo system is represented by the signal flow graph shown in Figure 1. The nominal values of the parameters are $K_1 = 1$, $K_2 = 5$ and $K_3 = 5$. Determine the overall transfer function $\frac{Y(s)}{R(s)}$ and its sensitivity to changes in K_1 under steady dc conditions, i.e., $s = 0$. [10]

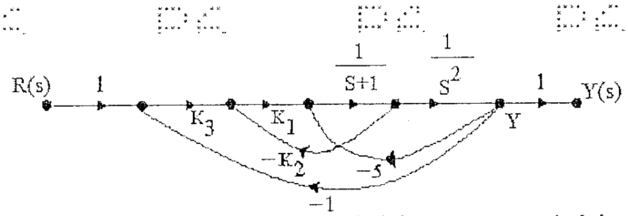

Figure 1

6. The open loop transfer functions of three systems are given as

a) $\frac{4}{(s+1)(s+2)}$ b) $\frac{2}{s(s+4)(s+6)}$ c) $\frac{5}{s^2(s+3)(s+10)}$

Determine respectively the positional, velocity and acceleration error constants for these systems. Also for the system given in determine the steady state errors with step input u(t)=1; ramp input r(t) = t and acceleration input $r(t) = \frac{1}{2}t^2$. [10]

OR

7. Obtain the unit – step response of a unity feedback control system whose open –loop transfer function is $G(s) = \frac{1}{s(s+1)}$. Obtain also the rise time, peak time, maximum overshoot and settling time. [10]

8. For unity feedback system given by $G(s) = \frac{K}{s(s+0.5)(s^2+0.6s+10)}$

a) Find the stability using RH criterion
b) for stable system find the range of K value. [8+2]

OR

9. Sketch the root loci for the system shown in Figure 2. [10]

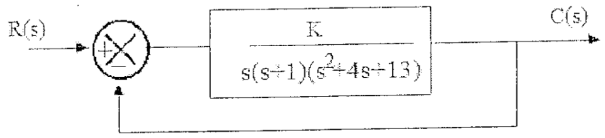

Figure 2

10. The forward path transfer function of a Unity-feedback control system is given as

$G(s) = \frac{K}{s(1+0.1s)(1+0.5s)}$

Draw the Bode plot of G(s) and find the value of K so that the gain margin of the system is 20 db. [10]

OR

11. Consider the system shown in Figure 3. Draw the Bode-diagram of the open-loop transfer function G(s) with K = 1. Determine the phase margin and gain margin. Find the value of K to reduce the phase margin by 10^0. [10]

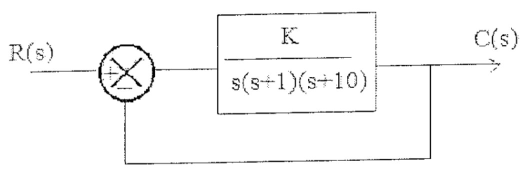

Figure 3

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