Code No: 115AD **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, July/August - 2023

CONTROL SYSTEMS

(Electrical and Electronics Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a)	Discuss about open loop system with an example.	[2]
b)	Explain how feedback effects Sensitivity of the system.	[3]
c)	What is Synchro?	[2]
d)	Draw the block diagram of the second order system.	[3]
e)	Define steady state response and steady state error.	[2]
f)	What does the term 'type' of a system indicate? What is its significance?	[3]
g)	What conclusion can be made if there is a row of all zeros in the Routh array?	[2]
h)	Explain the effect of adding zero to G(s)H(s) on the root loci.	[3]
i)	What is Gain cross over frequency and explain it in detail.	[2]
j)	What are frequency domain specifications?	[3]

PART - B

(50 Marks)

2.a) Find the impulse response of the system described $G(s)=\frac{2}{s^2+2s+6}, H(s)=\frac{1}{(s+2)}$.

b) What is the classification of control systems and discuss the importance of mathematical modelling of a control system. [5+5]

OR

3.a) State essential differences by giving suitable examples and highlight their merits and demerits for open loop and closed loop systems.

b) For the geared system shown below in Figure 1, find the transfer function relating the angular displacement θ_L to the input torque T_1, where J_1, J_2, J_3 refer to the inertia of the gears and corresponding shafts. N_1, N_2, N_3, and N4 refer to the number of teeth on each gear wheel. [4+6]

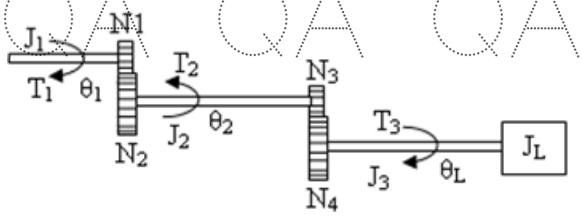

Figure 1

4.a) List the properties of signal flow graphs.

b) Obtain the transfer function of the following by using block diagram (figure 2) reduction technique. [4+6]

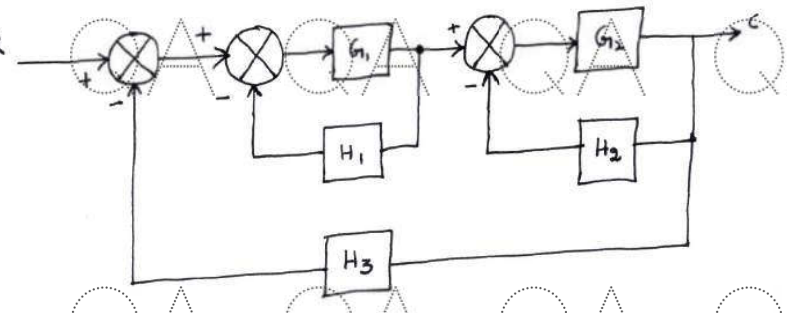

Figure 2

OR

5. Derive an expression for the transfer function of an armature-controlled DC servo motor. [10]

6. The open-loop transfer function of unity feedback system is $G(s)=\frac{4}{s(s+1)}$. Determine the nature of the closed-loop system for a unit-step input. Also determine rise time, peak time, and peak overshoot. [10]

OR

7.a) Obtain the time response of a first order system for a unit step input and plot its response.

b) Explain the effect of PD and PI controllers on the system response. [5+5]

8.a) Explain the Routh's criteria with an example.

b) A system has $G(s)H(s)=\frac{k}{s(s+2)(s+4)(s+8)}$, Where K is positive. Determine the range of K for stability. [4+6]

OR

9. Sketch the root locus of the system $G(s)=\frac{K(s+3)}{s(s+6)(s^2+2s+2)}$

a) Find marginal value of K

b) Find the value of K for damping ratio of 0.5. [5+5]

10.a) Explain the general procedure for constructing Bode plots.

b) The open loop transfer function of a unity feedback control system is given by $G(s)=\frac{1000}{s(0.1s+1)(0.001s+1)}$. Draw Bode plots and from these plots determine gain margin and phase margin. [4+6]

OR

11. Sketch the bode plots and determine the gain cross-over and phase cross-over frequencies for the transfer function $G(s)=\frac{10}{(1+0.5s)(1+0.1s)}$. [10]

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