Code No: R1622042 **R16** SET - 1

II B. Tech II Semester Supplementary Examinations, April - 2021
CONTROL SYSTEMS
(Com to ECE, EIE, ECC)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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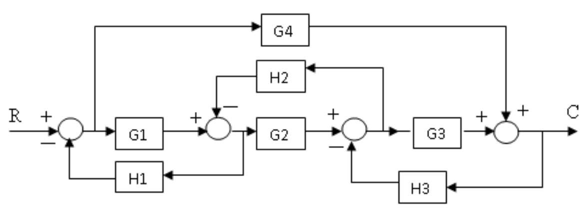
PART –A

1. a) Explain about the Positive feedback of loop with examples. (3M)
b) Derive the transfer function for AC servomotor. (3M)
c) What are the time domain specifications? (2M)
d) Explain about Routh's stability criterion. (2M)
e) Explain about Phase Margin and Gain Margin. (2M)
f) Explain about controllability (2M)

PART -B

2. a) Explain the construction and principle of operation Synchro transmitter. (7M)
b) Draw the equivalent signal flow graph and determine C(S)/R(S) using Mason's gain formula. (7M)



3. a) Damping factor and natural frequency of the system are 0.12 and 84.2 rad/sec respectively. Determine the rise time (t_r), peak time (t_p), maximum peak overshoot (Mp) and settling time (t_s). (7M)
b) Obtain the time response of a first order system for a unit step input and plot its response. (7M)

4. Sketch the root locus plot of unity feedback system with an open loop transfer function G(s) = K/(s(s +2) (s + 6)). Find the range of K for the system to have damped oscillatory response. Determine the value of K so that the dominant pair of complex poles of the system has a damping ratio of 0.6. Corresponding to this value of K. Determine the closed loop transfer function in the factored form. (14M)

5. a) Draw the Nyquist plot of G(S) H(S)= K/(S(2+S)(10+S)) and there from determine range of K for stability using Nyquist criterion. (7M)
b) Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. G(S) = 10/ (S(1+0.4S) (1+0.1S)). (7M)
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6. a) Explain about PID controller. (7M)

b) The open loop transfer function of a unity feedback control system is given by: G(s)=k/s(1+0.2s). Design a suitable compensator such that the system will have Kv=10 and P.M = 100^0. (7M)

7. The state equation of a system is given by (14M)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ -2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t), \quad t>0$$

a) Is the system controllable?
b) Compute the state transition matrix.
c) Compute $x_1(t)$ under zero initial condition and a unit step input.