DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Semester Winter Examination – Dec. - 2019

Branch: Electronics & Telecommunication Engineering **Sem.:- Fifth**
Subject:- Control System Engg (BTEXC 502) **Marks: 60**
Date:- 11/12/2019 **Time:- 3 Hr.**

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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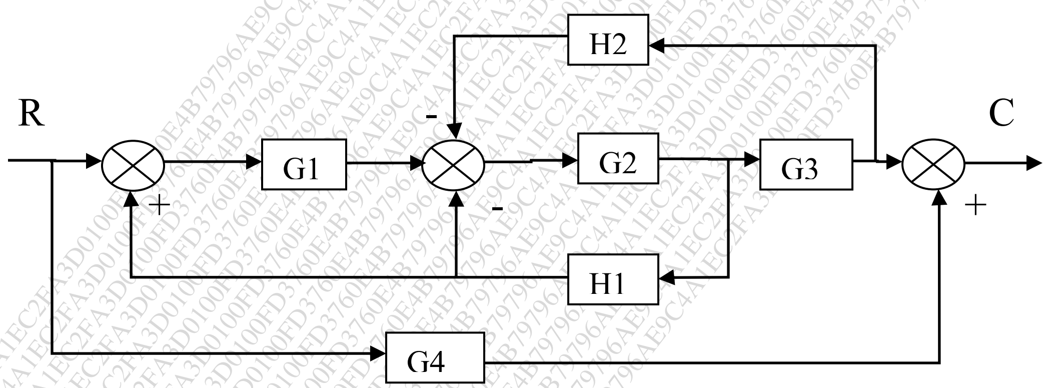
(Marks)

Q.1. a) Explain Open and Closed Loop Control System. (06)
Also Find the transfer function(C/R) for the block diagram shown in figure using Block Diagram Reduction Rule.



b) Determine the overall transfer function from signal flow graph shown below using Mason's gain formula, (06)

[redacted]

Q.2. a) For $G(S)=\frac{N}{S(1+aS)(bS^2+cS+d)}$ Find the Position error constant, Velocity error constant, Acceleration error constant and steady state error for unity feedback system for step input $R_0u(t)$, Ramp input $R_1tu(t)$. (06)

b) Define the term Rise time , Delay time and calculate all time domain specifications for the system having transfer function given by $T.F.=\frac{8}{S^2+4S+8}$ (06)

Q.3. a) Find value of 'K' by Routh's Criterion for unity feedback system having $G(S)=\frac{K}{S(S^2+4S+5)(S+2)}$ for which roots with zero real parts. (06)

b) For Unity feedback system with G(S) as given below , Draw the complete Root Locus for the system $\frac{K}{S(S+3+j2)(S+3-j2)}$ (06)

Calculate the values of asymptote, Centroid, No. of asymptote and the value of damped frequency at which locus crosses imaginary axis

Q.4. a) For the system having (06)

$$G(S)H(S)=\frac{K}{S(S+3)(S+5)}$$

find the ranges of K for stability, instability and the value of gain for marginal stability by Nyquist criterion.

b) Sketch the Bode Plot and Show that System is Conditionally Stable for unity feedback system characterized by OLTF.(Assume k = 1) (06)

$$G(S)=\frac{K(1+0.2S)(1+0.025S)}{S^3(1+0.001S)(1+0.005S)}$$

Q.5. a) Explain in details Feedback Characteristics of control system. Also discuss the effect of PID control action on second order system. (06)

b) List out the various compensation schemes used in practices. Consider a type 1unit feedback system with an OLTF (06)

$G(S)=\dfrac{K}{S(S+1)}$.It is specified that Kv=12Sec^{-1} and ϕ_{PM} = 40^0
Design lead compensator to meet the specifications

Q.6. a) Find state transition Matrix of system of system define by following state model also find transfer function of the system (06)

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

$$y=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

b) Comment on Controllability and Observability for the system represented by (06)

$$\dot{x}=\begin{bmatrix}-3 & 1 & 1\\ -1 & 0 & 1\\ 0 & 0 & 1\end{bmatrix}x+\begin{bmatrix}0 & 1\\ 0 & 0\\ 2 & 1\end{bmatrix}u$$

$$y=\begin{bmatrix}0 & 0 & 1\\ 1 & 1 & 0\end{bmatrix}x$$

Paper End