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JAYA GROUP OF INSTITUTIONS – THIRUNINRAVUR.

4TH SEMESTER – B.E / B.Tech.

INTERNAL ASSESSMENT – III (MODEL EXAMINATION - III)

Sub.Name: **CONTROL SYSTEM ENGINEERING** Date:06/**04/2015**

Sub.Code: **EC6405** Branch: **ECE**

Duration: **180** Minutes Max.Marks:**100**

PART – A (10X2=20)

1 .What is control system and give its basic elements?

2 .What is mechanical rotational system and mechanical translational system?

3 .What is a controller ? Give its four types.

4 .Find the value of K_v for the given open loop transfer function G(S)=20(S+2)/S(S+1)(S+3).

5 .What is phase and gain cross-over frequency?

6 .What are the advantages of bode plot?

7 .What is routh stability criterion?

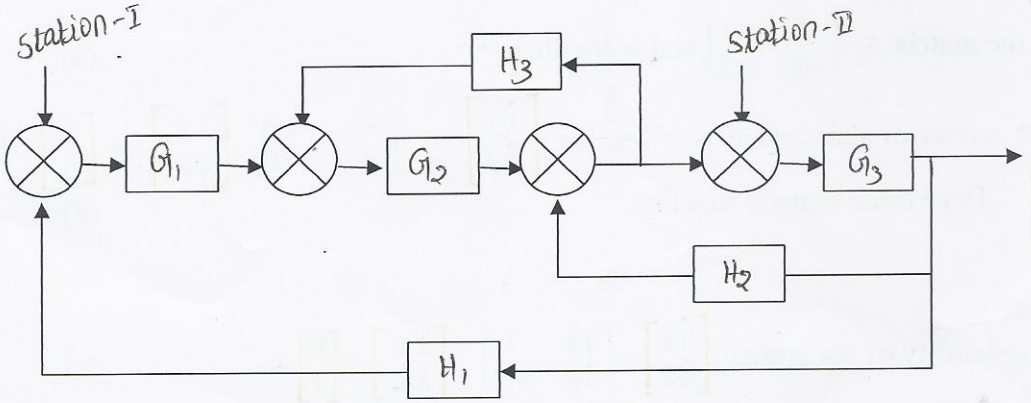
8 .What are the applications of root locus?

9 .What is controllability?

10.Define sampling theorem.

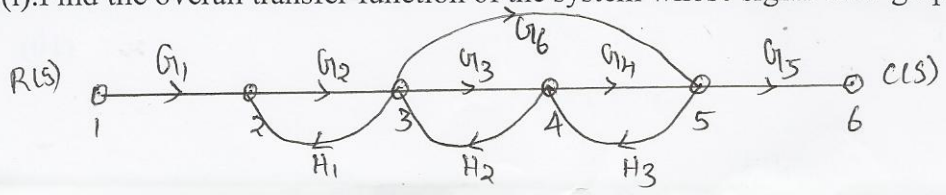
PART – B (5X16=80)

11(a).For the system represented by the block diagram, evaluate the closed loop transfer function when the input R is at station I and station II. (16)

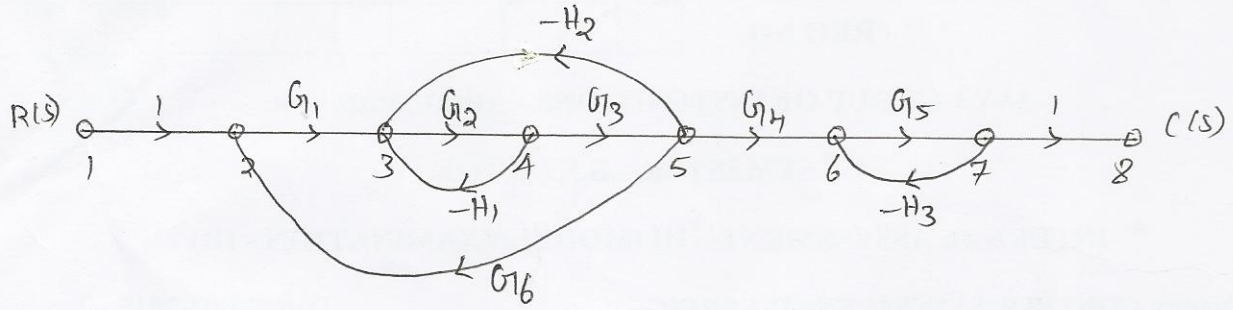


Or

11(b)(i).Find the overall transfer function of the system whose signal flow graph is (8)



(ii).Determine the closed loop transfer function of the given signal flow graph (8)



12(a)(i).Derive the expression for underdamped second order system. (8)

(ii).Obtain the response of unity feedback system whose open loop transfer function is G(s)=4/s(s+5). (8)

Or

12(b)(i).A unity feedback system has an open loop transfer function G(S)=10/s(s+2). Find rise time, percentage of overshoot, peak time, settling time for a step input. (8)

(ii).A unity feedback system has a function $G(s)=K(2s+1)/s(5s+1)(1+s)^2$. The input r(t)=1+6t is applied to the system. Determine the minimum value of K if the steady state error is to be less than 0.1 (8)

13(a).Plot the bode plot diagram for the following transfer function and obtain the gain and phase cross over frequency. G(S)=10/s(1+0.4s)(1+0.1s). (16)

Or

13(b).Sketch the bode plot for the following transfer function and determine system gain K for gain cross over frequency to be 5 rad/sec. $G(s)=Ks^2/(1+0.2s)(1+0.02s)$. (16)

14(a).Using routh stability criterion determine stability of the system represented by the characteristic equations, (16)

(i).$s^4+8s^3+18s^2+16s+5=0$, (ii).$9s^5-20s^4+10s^3-s^2-9s-10=0$, (iii).$s^3+3s^2+2s+K=0$

Or

14(b).Aunity feedback system has an open loop transfer function, $G(s)=K/s(s^2+4s+13)$. Sketch the root locus. (16)

15(a)(i).Consider the matrix $A=\begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$ and compute e^{At}. (8)

(ii).The state model of the system is given by $\begin{bmatrix} \dot{X}1 \\ \dot{X}2 \end{bmatrix} = \begin{bmatrix} -2 & 1 \\ 0 & -3 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U$, $Y=\begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \end{bmatrix}$. Determine transfer function. (8)

Or

15(b)(i).Find controllability of the system, $\begin{bmatrix} \dot{X}1 \\ \dot{X}2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$. (6)

(ii).Find obsevability of the system, $\begin{bmatrix} \dot{X}1 \\ \dot{X}2 \\ \dot{X}3 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 1 & -1 & 4 \end{bmatrix} \begin{bmatrix} X1 \\ X2 \\ X3 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} u$

$Y(t) = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} X(t)$. (10)