MBS-003-027601

MBS-003-027601 Seat No. ________

M. Sc. (ECI) (Sem. VI) (CBCS) Examination

April / May - 2018

Advanced Concepts of Control System : Paper-21

Faculty Code : 003
Subject Code : 027601

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Answer the following questions in brief : (any **Seven**) **14**

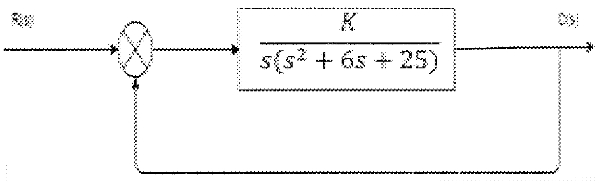
1. What is basic idea behind root-locus method ?
2. What is root contour ?
3. Enlist the commonly used representations for sinusoidal transfer functions.
4. Enlist basic factors that very frequently occur in an arbitrary transfer function.
5. How can one determine static position error constant ?
6. Draw the Bode diagram of $G(j\omega) = 1/j\omega$.
7. What is effect of additional poles ?
8. Why we need lead compensation ?
9. What is the Nyquist stability criteria ?
10. Show that the lead and lag compensators in cascade with open loop system acts as PI control for high frequencies.

2 Attempt any **two** of the following questions : (Each **7** Marks) **14**

1. Consider a unity-feedback system whose feed-forward transfer function is $G(s) = \frac{1}{s^2}$. It is desired to insert a series compensator so that the open-loop frequency-response curve is tangent to $M = 3dB$ circle at $\omega = 3\,rad/\sec$. Design appropriate series compensator.
2. Write a detailed note on root-locus analysis of control system.
3. What is lag compensation ? Explain lag compensation techniques based on the root-locus approach.

3 Answer the following questions :

1. Sketch the root-loci of the control system described by block diagram below : **5**

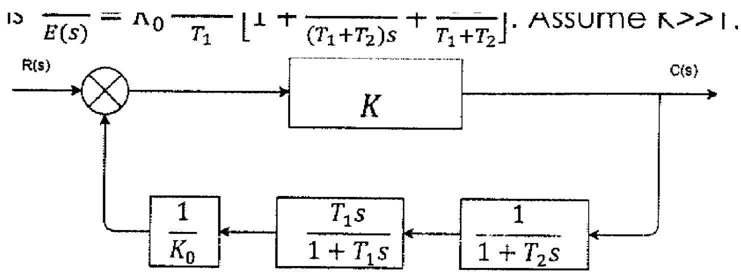


2. Write a note on compensators. **5**

3. Show that the transfer function $U(s)/E(s)$ of the **4**

system shown below is $\dfrac{U(s)}{E(s)} = K_0 \left[\dfrac{T_1 + T_2}{T^1} + \dfrac{T_1 T_2 s}{T_1 + T_2} \right].$

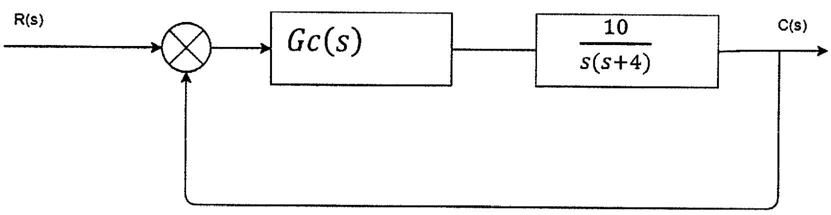
Assume $K >> 1$.



OR

3 1. Describe preliminary design considerations. **5**

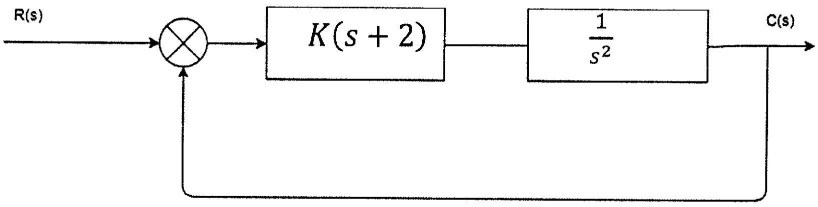
2. For the system shown below, design a lag compensator $Gc(s)$ such that the static velocity error constant k_v is 50 sec^{-1} without changing the location of original closed loop poles which are at $s = -2 \pm j\sqrt{6}$. **5**



3. Write a short note on stability analysis using Nyquist stability criterion. **4**

4 Answer the following questions :

1. For the space vehicle control system shown below, determine the gain K such that the phase margin is 50°. What is the gain margin in this case ? **5**



2. Enlist basic factors that very frequently occur in an arbitrary transfer function. Explain any one of them in detail. **5**
3. Explain the relationship between system type and log-magnitude curve. **4**

5 Answer any **two** of the following questions : (Each 7 Marks) **14**

1. Enlist basic factors that very frequently occur in an arbitrary transfer function. Explain each of them in detail.
2. Compare log-magnitude curves with phase plots.
3. Sketch root-locus plot for the system with complex-conjugate open-loop poles described below.

$$G(s) = \frac{K(s+1)}{s^2 + 2s + 3}, \quad H(s) = 1$$

4. Explain in detail relative stability.