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PAR-003-1276002 Seat No. _____

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

August / September - 2020

Advanced Concepts of Control System : Paper - 22

Faculty Code : 003

Subject Code : 1276002

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

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

(1) What is effect of additional zeros?

(2) What is order of the system?

(3) Find inverse Laplace of the system given by equation :

$$G(s)=\frac{s+2}{(s+1)(s+3)}$$

(4) Explain open loop system in brief.

(5) How can one determine static velocity error constant?

(6) Draw the Bode diagram of $G(j\omega)=(1+j\omega T)^{-1}$.

(7) What is basic idea behind root-locus method?

(8) What are compensators?

(9) What is non-minimal system?

(10) What is Routh's criteria of stability?

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

(1) Explain in detail relative stability.

(2) 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.

(3) Sketch root-locus plot for the system with complexconjugate open-loop poles described below.

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

3 Answer the following questions :

(1) Write a short note on stability analysis using Nyquist stability criterion. **5**

(2) Plot a Bode diagram for the following open-loop transfer function. **4**

$$G(s)=\frac{20}{s(s+1)(s+10)}$$

(3) Write a note on compensators. **5**

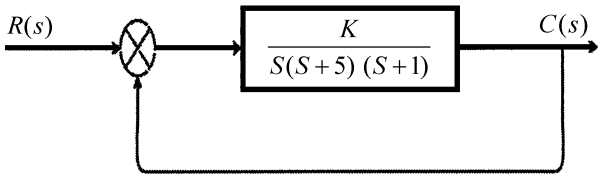
OR

3 Answer the following questions :

(1) Sketch polar plot for a system described by transfer function $G(s)=\frac{1}{s(Ts+1)}$. **5**

(2) What is compensator? Explain. **5**

(3) Sketch the root-loci of the control system described by block diagram below. **4**



4 Answer the following questions :

(1) Describe preliminary design considerations. **5**

(2) Consider a lag-lead compensator $Gc(s)$ defined by, **5**

$$Gc(s) = Kc\frac{\left(s+\frac{1}{T_1}\right)\left(S+\frac{1}{T_2}\right)}{\left(S+\frac{\beta}{T_1}\right)\left(s+\frac{1}{\beta T_2}\right)}$$

Show that at frequency $\omega_1 = \frac{1}{\sqrt{T_1 T_2}}$ the phase angle of $Gc(j\omega)$ becomes zero. (This compensator works as lag compensator for $0 < \omega < \omega_1$ and acts at lead compensator for $\omega_1 < \omega < \alpha$)

(3) Explain the relationship between system type and logmagnitude curve. **4**

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

(1) Explain in detail relative stability.

(2) What is lag compensation? Explain lag compensation techniques based on the root-locus approach.

(3) Summarize general rules for constructing root-loci.

(4) Write a detailed note on root-locus analysis of control system.