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Printed Pages—4 EE—502

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2007 Roll No.

B.Tech.

FIFTH SEMESTER EXAMINATION, 2005-2006

CONTROL SYSTEM

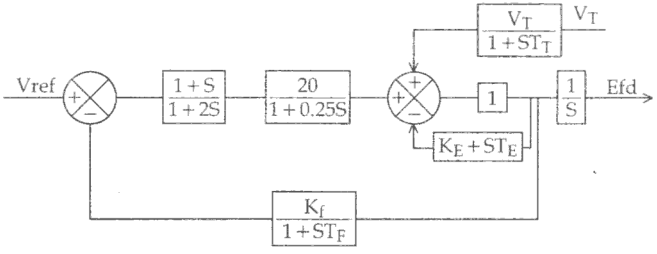
Time : 3 Hours *Total Marks : 100*

FTH

Note : *(i) Attempt ALL the questions.*

(ii) Be precise in your answer.

1. Attempt *any four* of the following : **(5x4=20)**



Take $K_f = 1$, $T_f = 0$, $K_E = 1$, $T_E = 1$, $V_T = 1$, $T_T = 1$.

(a) Find Efd (s) / Vref (s) at $V_T = 0$.

(b) Find Efd (s) / V_T (s) at $V_{ref} = 0$.

(c) Draw signal flow diagram for both (a) and (b)

(d) Explain masion's gain formula with an example

(e) Why is closed loop control system prefered over open loop ?

(f) Explain difference between positive feedback and negative feedback.

2. Attempt *any two* of the following : **(10x2=20)**

(a) Explain the effect of adding a pole to a second order system. When is it useful to add a zero to the system ?

(b) With respect to transient response of a second order system for step input, define the following :

(i) Time delay

(ii) Rise time

(iii) Settling time

(iv) Relative peak overshoot

(v) Peak time

(c) Calculate Kp, Kv, Ka for :

$$\frac{S^2(S+5)}{S(S^3+21S^2+147S+343)}$$

write clearly what are the inputs used for calculating each of these error constants. Calculate steady state error for each of these inputs.

3. Attempt *any two* of the following : **(10x2=20)**

(a) In connection with Bode plot :

(i) Define band width

(ii) Define cut-off frequency

(iii) Define corner frequency

(iv) explain corrections to be made at corner frequency and discuss importance of band width.

(b) Draw circuit diagram of a lag network, draw its Bode plot (both magnitude and phase)

(c) Explain polar plot and inverse polar plots with examples.

4. Attempt *any two* of the following : **(10x2=20)**

(a) For the following characteristics equation of systems find out their stability using Rouths criterion.

(i) $f(s) = 13s^7 + 5s^6 + 8s^5 + 4s^3 + 20s^2 + 15s + 1.$

(ii) $f(s) = 3s^4 + 10s^3 + 5s^2 + 5s + 2.$

(iii) $f(s) = 3s^4 + 10s^3 + 20s + 10(1 + k).$

(b) Explain step by step procedure for ploting root locus. Give also expression for the angle at which assymptots leave real axis, point of intersection of assymptots, angle of departure and angle of arrival.

(c) Explain Nyquist criterion with an example.

5. Attempt *any two* of the following : **(10x2=20)**

(a) How can the limit cycle and its stability found using describing function method for a non-linear system ?

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(b) Explain feedback compensation with PID controller.

(c) Linearize the following non-linear system.

$$\dot{x} = 4x^2 + y + z$$

$$\dot{y} = x - 2y^3$$

$$\dot{z} = x + y + yz$$

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