B.E. Instrumentation Engineering Fourth Semester

IN402 - Feedback Control Systems Paper-I

P. Pages : 3 **GUG/W/18/1575**

Time : Three Hours * 1 2 3 9 * Max. Marks : 80

Notes : 1. Same Answer book must be used for each section.
2. All questions carry as indicated marks.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.

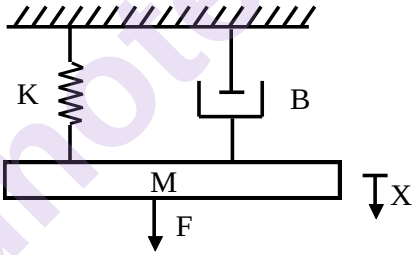
1. a) Recognize the basic element of feedback control system with example. **8**

b) Write the expression for transfer function of thermal system. **8**

OR

2. a) Draw the force – current analogy for the fig. & also draw the direct analogous circuit. **6**

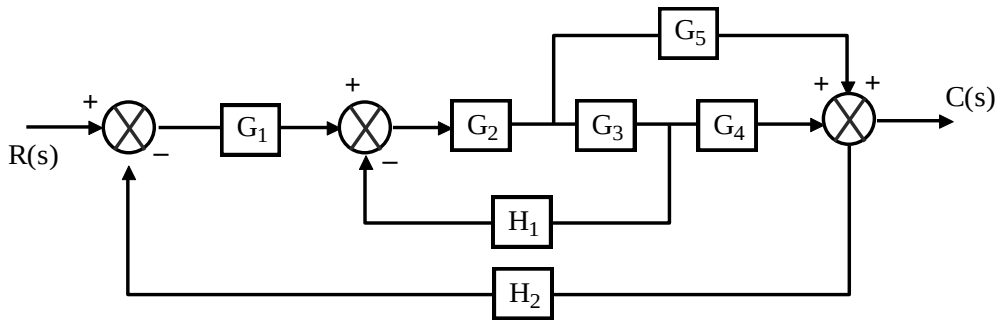
b) For the system shown in fig. Write the system equation. **6**



c) Differentiate between open loop & closed loop system. **4**

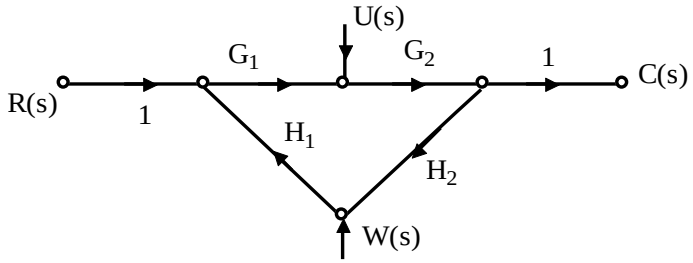
3. a) Enlist the various rules to derive transfer function of SFG. **8**

b) Find the transfer function for the block diagram shown in fig. below. **8**

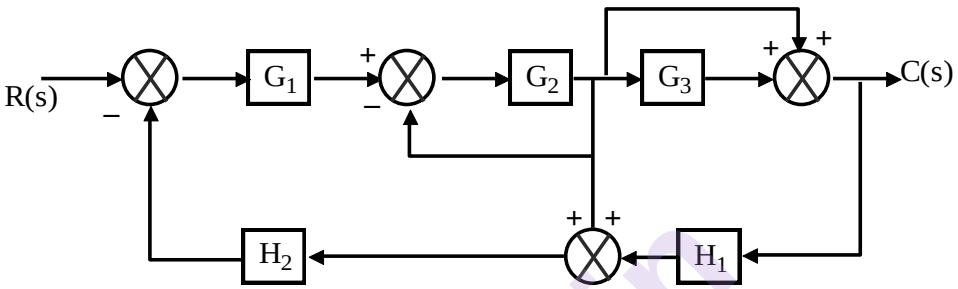


OR

4. a) Find the T. F. of the following. **8**



b) Use signal flow graph & Mason's gain formula, obtain the overall gain of the system depicted in fig. **8**



5. a) Express the steady state error determine by application of final value theorem of Laplace transform. **4**

b) Define the following term. **4**

i) Rise time ii) Delay time

iii) Settling time iv) Peak overshoot

c) A second order servo system has a unity feedback $G(s) = \frac{500}{s(s+15)}$ sketch the transient response for unit step input, & calculate peak overshoot, settling time, peak time & rise time. **8**

OR

6. a) Identify the effect of standard test signals on steady state error for linear time invariant system. **6**

b) The control system having unity feedback has **7**

$$G(s) = \frac{20}{s(1+4s)(1+s)}$$

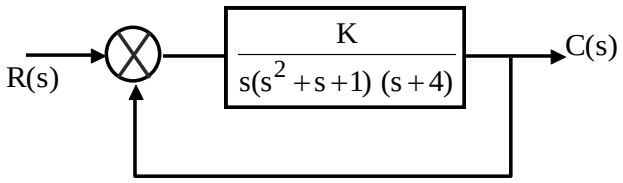
Determine :

i) Different static error coefficients.

ii) Steady state error if i/p = $r(t) = 2 + 4t + \frac{t^2}{2}$

c) Discuss the important points to solve the problem on transient response specification. **3**

7. a) Determine the range of K for stable operation. **8**



b) Draw the root locus for the system $G(s) = \frac{K}{s(s+3)(s+6)}$ & obtain the value of K when ξ = 0.6 from root locus. **8**

OR

8. a) Asses the stability & state the Routh's criteria for stability of LTI system. **5**

b) Enlist the basic properties of root loci **4**

c) Sketch the root locus for a unity feedback system with $G(s) = \frac{K(s+1)}{S(s-1)}$ Prove that the part of root locus is a circle. **7**

9. a) Explain Nyquist stability criteria & its significance. **4**

b) Define the following terms. **4**

i) Gain margin ii) Phase margin

iii) Gain cross over frequency iv) Phase crossover frequency

c) Sketch the Bode plot of following system. **8**

$$G(s) = \frac{512(s+3)}{s(s^2+16s+256)}$$

OR

10. a) Sketch the Bode plot of the following $G(s)\,H(s) = \frac{10}{s(s+1)(s+5)}$. Determine the gain cross over frequency, phase margin & gain margin. Also comment on stability of system. **8**

b) Evaluate the static error coefficients from initial slope of Bode Plot. **4**

c) Define resonant peak, resonant frequency & bandwidth. **4**

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